AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 5, No. 39 WEEKLY. | NEW YORK, SEPTEMBER 30, 1882. | $3.00 per Annum. SINGLE COPIES, 6 CENTS.

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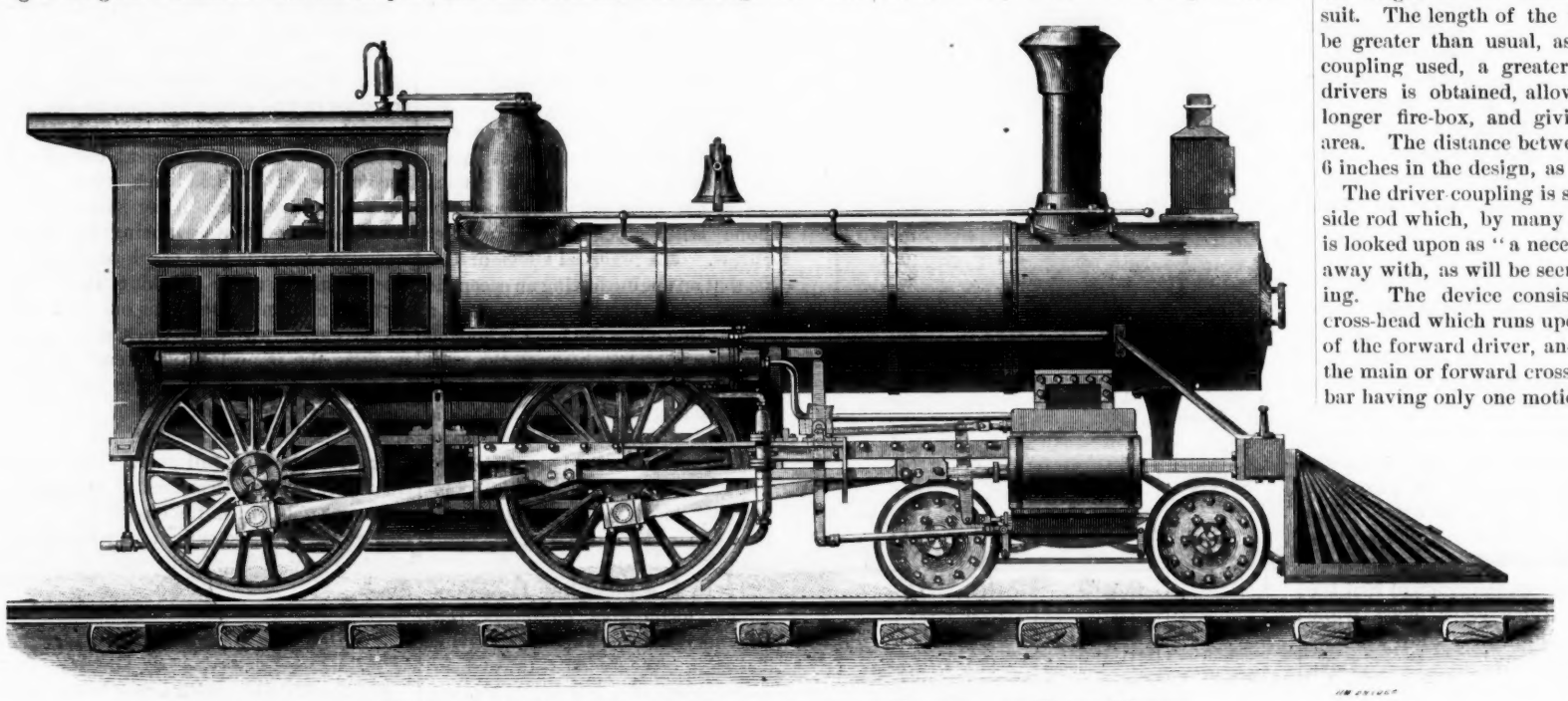
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER

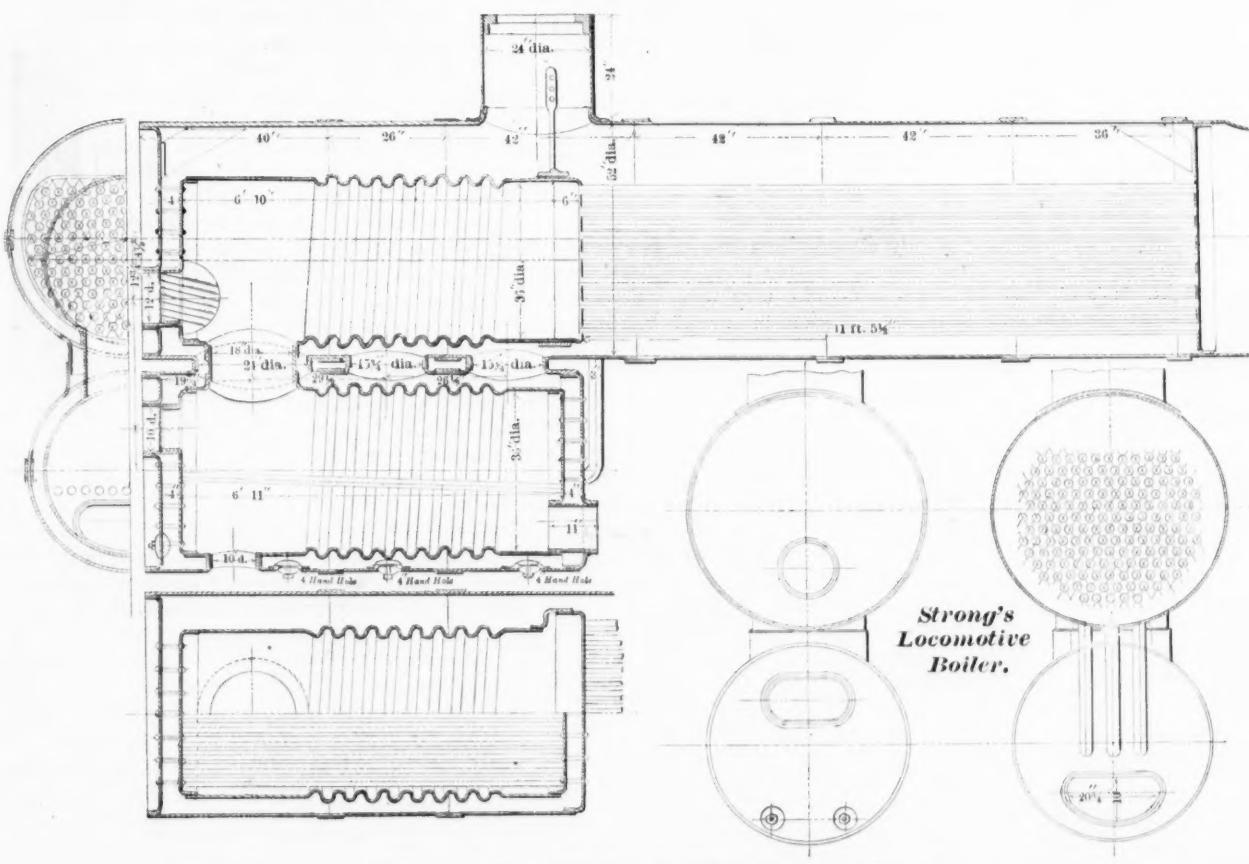
Strong's Locomotive Boiler, Driver Coupling, Heater and Valve Motion.

The designer of the locomotive shown in the accompanying engravings conceived the idea, some eighteen months ago, of attempting to design a locomotive that should possess all the good qualities that distinguished the American locomotive, without its defects. Being familiar with American practice and construction, and wishing to know something of English and Continental practice, he therefore visited most of the leading railway lines in England and on the Continent, with a view of carefully observing all the good points in their practice, and upon his return designed the locomotive here presented, which embodies in concrete form the results of his careful study of the problem. The points in which this engine differs from the American type are in the construction of the boiler, the mode of coupling the drivers, the valves and valve motion, and the way in which the feed-water is heated, while the American equalizing bars, swinging truck, American frames, cab and pilot are retained.



STRONG'S LOCOMOTIVE BOILER, DRIVER COUPLING, HEATER, AND VALVE MOTION.

The boiler, which is shown in detail on this page, is so designed as to do away with what are recognized as a great nuisance by all railroad men, *i. e.*, the crown bars and side stays. This is accomplished by making the boiler and fire-box cylindrical in shape, and reducing other parts to natural forms of strength, there being no flat surfaces except the heads. The fire chamber is a 36″ flue, preferably corrugated to give it greater strength. This is contained in a cylinder, which is joined to the main cylinder of the boiler by three necks having flanged joints. The main barrel or cylinder of the boiler has a cylindrical combustion chamber, which is connected to the fire chamber through the back neck. The water circulates around this connection and also through the other necks. There are three circulating tubes from the barrel down to the front of the fire chamber to insure circulation. The sides of the fire chamber and also of the combustion chamber are only stayed to their shells at the ends, and a clean heating surface is presented, which it is claimed will, if corrugated, have contraction and expansion sufficient in surface to prevent the adhesion of scale; and being likewise free from the shell, there will be no risk that the contraction and expansion of these parts will break the stays also, as is usually the case.



END AND LONGITUDINAL SECTIONAL VIEWS.

The fire-box is also intended to insure complete combustion of the fuel by burning the gases and sparks, as the connection between the fire and combustion chambers is well forward. And the combustion chamber is also provided with an air valve having a perforated tile so arranged, that, as the gases come from the fire chamber, they are thoroughly mingled with the heated air coming through the tile. The boiler tubes may be made long or short, according to the kind of coal to be burned, increasing or decreasing the length of the combustion chamber to suit. The length of the fire chamber may be greater than usual, as with the driver-coupling used, a greater distance between drivers is obtained, allowing the use of a longer fire-box, and giving a longer grate area. The distance between drivers is 9 feet 6 inches in the design, as here shown.

The driver-coupling is so arranged that the side rod which, by many master mechanics, is looked upon as "a necessary evil" is done away with, as will be seen from the engraving. The device consists of an auxiliary cross-head which runs upon a guide outside of the forward driver, and is coupled with the main or forward cross-head by a straight bar having only one motion, which is that of the piston. From this auxiliary cross-head, the rear driving-wheel is driven in the same manner as the forward wheel, from the regular or front cross-head. The distance between centers of cross-heads is the same as between centers of drivers, and consequently the action and angles are always alike on both wheels; and as the motion of the connecting link is in a straight line, there is no danger of its breaking when properly proportioned. This link

can be made of any length within the limits of wheel base, and the drivers can be spread so as to admit of a longer fire-box. This, with locomotives burning soft coal, is a very desirable feature.

A better distribution of wearing surfaces on brasses of crank-pins is also claimed than is the case with the ordinary construction, where the power for both wheels is transmitted through the forward pin. The object of this device is to overcome the pounding upon the rails and the flattening of tires of the front drivers when such pounding and flattening are caused by the transmission of power to the rear wheel through an angle, the downward throw of the side-rod being at the same time arrested. This throw, in a speed of fifty miles an hour, strikes a blow of many tons, from 250 to 350 times a minute. Such blows come directly on the crank pin and through the driver are transmitted to the rail, while the center of the rod is thrown downward towards the ground with great force.

The valve motion is a modification of the Joy and Brown valve gears, arranged to work the exhaust and steam valves independent of one another, so that any degree of expansion may be obtained without its accompanying back pressure and compression, as on the single valve. This, if the designer's expectations, as to durability, are fully realized, will be appreciated by all who have taken cards from an ordinary locomotive at high speeds, cutting off at six inches, with 30 to 35 per cent. of back pressure and compression.

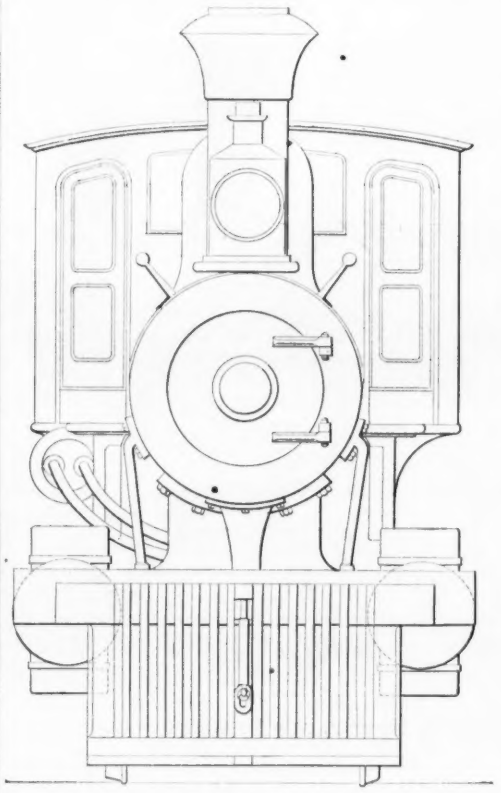
The valves are what are known as grid-iron valves, working close to the ends of the cylinders, double ported so as to give a quick opening. The steam or induction valve is in the steam chest on top of each cylinder, and the exhaust valve on the under side, so that the condensation is drained into the exhaust chamber under the cylinder, from which it is taken by an expansion steam trap, instead of cylinder cocks. The wear on valves of this class is very slight as the compression partly balances the steam or induction valves just at the moment that the movement of the valve takes place, while the expansion of the steam to a low pressure takes part of the load off the exhaust valve at the time of its movement. The clearances are very low, being about 8 per cent., while the clearances on an ordinary locomotive are about 40 per cent. This would only be possible with an independent exhaust, as the point of closing on an ordinary exhaust would drive the compression beyond limit, if the large clearance space was not allowed.

The feed-water is heated by a portion of the exhaust, in a heater arranged under the running board, in principle (the purifier being omitted) similar to that employed in Strong's Feed-Water heater, as described in the AMERICAN MACHINIST, May 22, 1880. This heater is constructed of a wrought-iron tube, 13″ outside diameter, to the end of which is fixed a cast-iron head, having two chambers divided by a diaphragm. Into this head are screwed 60 brass tubes, 1″ outside diameter, 14 feet long, and having 210 feet heating surface. In each of these tubes is an inner tube, which is screwed into the diaphragm and reaches nearly to the end of the heating tube. The inner tubes are designed only for circulation. The exhaust from the two engines being connected, one to the chamber into which the heating tubes are screwed, and the other to the chamber into which the circulating tubes are screwed, admits of a constant backward and forward flow of the exhaust, caused by the alternate variation of pressure between the two sides on the quarter beats of the engine. No exhaust is discharged or carried back to the exhaust pipes, while the condensation is carried away in a drip which is trapped.

The exhaust steam is taken from the exhaust pipes in the saddle by tapping in a two-inch pipe into which are screwed nipples having half cup shaped projections to catch a portion of the exhaust, while the main portion of it goes unobstructed to the blast nozzles. It is estimated that only about 12 per cent. of it is required to heat the water to 212° Fahrenheit.

The water is fed into the heater at its front end and passes through and out at the back, then passes through a short pipe to the check just forward of the cab. A pump is used to pump the water, while an injector is used as an auxiliary. One of these heaters recently tested showed an increase in evaporation of 1.09 pounds of water per pound of coal, representing a saving of 22 per cent. on an ordinary locomotive over feeding cold water.

The objects which have been aimed at in the general design of the locomotive here shown, are: To effect a construction which shall be both economical and as fast as desirable; to have at all times a reserve of power for a stormy day or a heavy train; that it shall be simple and not liable to derangement; that it shall be safe for those who run it, as well as those who ride behind it, while burning its coal in such a manner as to do away with cinders and smoke. The designer is George S. Strong, Seventh and Chestnut streets, Philadelphia.



FRONT VIEW OF LOCOMOTIVE.

Locomotive Notes.

SMART ENGINES—DOCTORING A LOGY ENGINE.

BY ANGUS SINCLAIR.

Nearly all engineers like to run locomotives that are capable of making fast time. There is something very human about the sentiment. A pride in speed actuates alike the man who trots his ten thousand dollar steed, amidst the plaudits of wealth and beauty, and the ragged urchin who urges his donkey to outstrip the pace of his fellow huckster. There prevails a fondness, among the men who handle the throttle, for engines that can get away from stations at a speed which endangers the neck of every man who attempts to catch on, after the drivers have made six revolutions. Many of the stories current among gossiping engineers, turn upon the wonderfully smart performances of certain engines. Among old timers, the extraordinary smartness of V-hook locomotives is a prolific subject of romance.

To produce a locomotive that shall be smart in all points of valve travel, conditions of steam distribution are requisite which the ordinary link motion does not furnish. The steam ports would require to be opened, promptly at the beginning of the stroke, wide enough to admit steam to the cylinder at nearly boiler pressure, and as promptly closed, producing an early cut-off, carrying expansion close to the end of the stroke, then holding the exhaust open during the return of the piston, to avoid compression. Although these conditions cannot be reached in locomotive practice, a motion planned to approximate them, as nearly as practicable, will produce the best working engine. With a link motion the characteristics of the engine can be determined by the throw of eccentrics and the size and set of the valves. An engine that is quick in picking up a train and getting away from a station, is not likely to excel in maintaining a high speed on the road. The engine that gets away from a station like a race-horse, has generally short outside lap, and no inside lap, or the valves may be cut out inside, giving excessive exhaust lead. This is a very wasteful form of motion, and throws away coal. Good dimensions of valves for passenger engines of the ordinary type are: $\frac{7}{8}$″ outside lap, and line and line inside, with an eccentric throw of 5½ inches. Engines that pull freight do well with $\frac{3}{4}$″ outside lap and $\frac{1}{8}$″ inside lap. The first named engine will not be particularly smart at getting away from a station, but she will make good speed on the road. The second engine will not prove very smart under any circumstances; but when economical work is required, and a heavy train has to be pulled up a steep grade, that engine will do the work. Short throw of eccentrics has a tendency to make an engine logy, and, other details being equal, a short travel of valve is not conducive to economy, for eccentrics with a long throw will cause the valve to open the port wider when cutting off at the same point, than will be done with eccentrics of shorter throw. The practical effect of this is, that an engine having an eccentric throw of 4½ inches cannot take a train along when the lever is hooked back to 6 inches, because the port opening is too small to admit steam approaching boiler pressure; while an engine having one inch more eccentric throw would give the opening necessary to take the train comfortably along, and admit of the long expansion assured by the short cut-off.

There is a prevailing impression among locomotive engineers, that advancing the eccentrics and giving the engine plenty of lead, will invariably smarten her up. In many cases this is a mistake. The magnitude of lead, that can be advantageously given to an engine in full gear, depends upon how rapidly the lead increases as the links are hooked towards the center. Engines with short eccentric rods often increase the lead so rapidly, that $\frac{1}{8}$″ or $\frac{3}{16}$″ of lead in full gear would cause injurious premature admission, when the engine was hooked up to six inches.

Lost motion has a tendency to obliterate lead. When the valve motion gets badly worn, it is often found that the valve laps some distance over the port at the beginning of the stroke, instead of partially opening it for the admission of steam. This defect is obviated, to some extent, by advancing the eccentrics till the required lead is obtained. Sometimes, however, the valve motion gets in such bad shape from wear, that merely advancing the eccentrics is not an effectual remedy.

When Billy Evans was running on the Missouri Southern, he was pulling a lively passenger train, that had to make numerous stops, but still was expected to get through on time. His engine had made a long mileage without repairs, for the company was so short of power, that engines were run till they would no longer hold together. Billy's engine began to grow logy, and he was constantly harassed to make running time. He tried advancing the eccentrics, and found that beyond a point, which was by no means a point of smartness, the engine acted worse. While the engine remained in tolerably good condition, Billy was able to do most of his running with the lever in the first notch from the center, but now she was useless short of the second notch. When run there, a third more coal was burned than formerly sufficed for each trip. The eccentrics were worn oval, the links had become flat, and the pins had lost all semblance of true fitting. The management of the Missouri Southern in those days permitted great latitude to engineers in the matter of repairing their engines. In fact, engineers might entirely rebuild their engines, if they could find time and material to do the work. Billy availed himself of this privilege to labor on his engine. Having got all the lost motion taken up—what of it could be reached conveniently—Billy proceeded to diagnosticate the valve motion. Armed with a six-inch tram and pair of dividers, and reinforced by two stout wipers wielding pinch bars, he went to work. Beginning at the dead center, he traced the valve positions at each inch of the piston stroke, just as motion curves are now taken. A diagram constructed in this way showed that the valve would move a little at the beginning of the stroke, then remain motionless during part of the time the piston was traveling. In one notch this loss of movement continued during a third of the stroke. The lines of opening in the short travels were flat, showing that the port was not opened sufficiently wide to admit steam enough to do work. Then, on advancing the lever, an opening was made which lingered in closing till the stroke was well advanced. There was no quick opening and no prompt closure. Billy schemed to find a plan for making the valve open the port wider at the beginning of the stroke, so as to effect a decent cut-off when the engine was hooked back where most of the work was done After several experiments he found that advancing the back-up eccentric towards the crank-pin improved his opening, while working close up in forward motion. From this cue he worked. As the engine was never worked in the back motion, the opportunity offered itself of sacrificing the accuracy of the back gear to improve the forward motion So he advanced the back-up eccentric till the valve showed $\frac{1}{4}$″ lead in full gear. This change smartened up the forward motion so much that Billy was able to run the engine again in the first notch, economically, and without experiencing any difficulty in making running time.

Water Gauge Reflector.

We illustrate herewith a new water gauge reflector for steam boilers, which is simple in construction, and may be readily attached to any glass water gauge. It will be seen from the engraving that the inner surface of this reflector is of a concave form, so that when placed behind a glass water gauge, the the water line will by reflection be extended across the face of the reflector. This being true, the person in charge of the boiler need not advance to some near or particular point, in order to ascertain the height of water in the boiler, for the line is visible from various positions.

It is somewhat surprising to know by a practical test with one of these reflectors, in how dull a light the water line can be distinctly seen. This reflector will be found particularly valuable, where boilers are located in comparatively dark cellars or in dimly lighted rooms, requiring the burning of a gas jet or other artificial light.

It will be found that, in most intances, a special light for this purpose can be dispensed with altogether by using one of these reflectors, and the expense of light saved will soon more than cover the nominal cost of this reflector.

It is made in different lengths to fit any glass gauge by the H. B. Smith Machine Company, 925 Market street, Philadelphia, Pa.

Crude petroleum put into steam boilers will loosen and precipitate the scale, but will not remove it outside of the boiler and fire-room. These facts do not seem to be fully realized until the boiler is burned or otherwise injured by excessive heat upon plates with which the water cannot come in contact. Boilers should in all cases be frequently and carefully washed when using substances for the prevention of scale.

Fair of the New England Manufacturers' and Mechanics' Institute.

The ancient potentate who offered rewards for those who could devise new pleasures would need a full treasury were he to visit the exhibition in Boston. The fair is replete with everything of use in serving the wants of the community.

The luxuries of the last generation become the necessities of this, and the latest marvels of mechanism and service will soon be considered indispensable to comfort.

The demands of civilization are the generalization of the proclamation of the luxurious monarch, because each of these triumphs of skill is produced in consequence of a demand by the public.

The exhibition is unusually full, and any attempt to summarize the whole would require the omission of essential features.

On entering the portion of the hall devoted to machinery, attention is called to a waterfall about thirty feet in height, which is supplied by a Follansbee wrecking pump. Near the base of this cataract the Deane Steam Pump Company have an extensive exhibit of their pumps, including mining, fire and boiler pumps, a duplex pump which supplies a fountain in the center of the hall.

The construction of these pumps is clearly shown by means of a boiler feed pump, with one-half cut away, disclosing a sectional view of the interior, whose operation is shown by means of a hand lever arranged to move the pump rod.

Beginning with the motors, there are a number of steam engines in the fair. Among the principal ones may be mentioned a Porter-Allen engine, 11½″ by 20″ cylinder, which runs 230 revolutions per minute, developing 125 horse power when working in connection with a condenser, and 100-horse power when used as a non-condensing engine.

Kendall & Roberts, of Cambridgeport, exhibit ten engines, the largest of which has an 18″×36″ cylinder; also some special hoisting machines, besides some feed-water heaters.

Hill, Clarke & Co., of Boston, have one of the most extensive exhibits of iron working machinery, comprising latest designs of the leading builders.

They exhibit a Hartford (Buckeye) engine, 12″ by 21″ cylinder, which runs at 181 revolutions. They also exhibit three other engines, besides a Deane condenser for a 250-horse power engine, and an Ericsson caloric engine and a Westinghouse engine, such as was described in the AMERICAN MACHINIST for September 16.

The Swampscot Machine Co., of South New Market, N. H., exhibit a 50-horse power engine with their automatic cut-off, and several plain slide valve engines, also boilers, radiators and connections for steam heating.

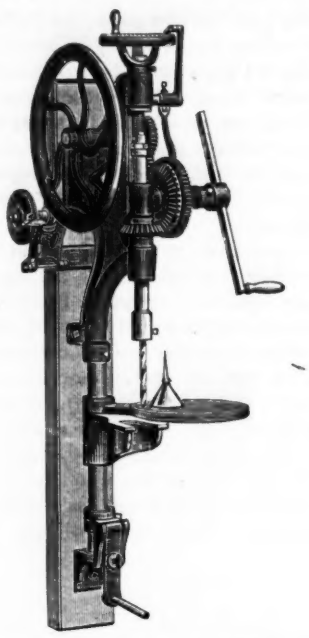
The Exeter Machine Works, Exeter, N.H., have a plain slide valve engine and blowers.

Gardiner C. Hawkins, of Boston, shows two of his high speed engines. They are vertical engines with slide valves, with Mayer variable cut-off on back.

A. F. Upton exhibits the Jarvis attachment to the Corliss boiler, and two Lawrence engines, the larger of which measures 12½″ by 20″ cylinder and runs at 185 revolutions.

The Brayton Petroleum Engine attracts much attention. It is operated by the combustion of a mixture of petroleum and air. The base of the engine serves as a reservoir for the condensed air, and the oil is in a tank near by. This engine is said to give five horse power net, and consume one-sixth of a gallon of oil per hourly horse power. The floor space, including fly-wheel, is eight feet long by two and a half wide. It is virtually a gas engine, except that the combustion is not rapid enough to be termed an explosion. As in the case of gas engines, it is started by a match, no previous fire, or preparation of any kind being necessary.

At each industrial fair there is always a certain class of exhibits which are so evenly matched in points of merit, or of such great importance to many interests that they constitute one of the main attractions of the fair.



UPRIGHT DRILL WITH GRINDING ATTACHMENT.

At the Cincinnati Exposition two years ago, the greatest issue lay in the competition of the makers of stationary engines with automatic cut-off; at the Atlanta Cotton Exposition competition naturally centered about the cotton gins. At the Mechanics' Institute Fair last year, the grand exhibit of shoe-making machinery with its perfect system of organization by which such of the special machines used in shoe manufacture was in full operation and also in its proper place in respect to the m .chines for other work on shoes.

At the Mechanics' Institute Fair the building is illuminated by four different systems of electric lighting, arranged so as to give each an equitable opportunity of showing the merits claimed for each light.

The smooth, even light shows what strides have been made in the way of securing those features of uniform tension of electricity, satisfactory feeding apparatus in the lamps, and homogeneous carbons, since the time of the Mechanics' Association Fair, four years ago, where only arc lights were exhibited.

The first exhibit is that of the Weston Electric Light Co. of New England, who have a plant of 200 Maxim incandescent lights of 24 candle power each, which illuminate a portion of the upper gallery, including the textile fabrics exhibit, where a pure white light is essential to bring out the various shades of color with desired perfection.

This company also exhibit a plant of 80 Weston arc lights which illuminate nearly all of the second floor, and 16 of these lights are on a tower outside of the building to illustrate a method of lighting public squares.

The graceful design of a new ornamental Weston lamp is to be commended, as so few electric lamps give any evidence that attention has been paid to artistic proportion.

The dynamo machines in this exhibit are driven by a Hartford (Buckeye) Engineering Company engine, which forms a portion of the exhibit of Hill, Clarke & Co.

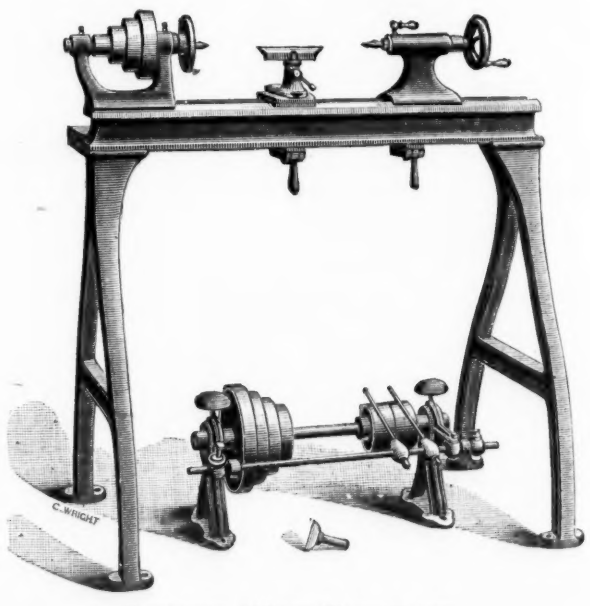
The Thomson and Houston system of electric lighting is shown by the American Electric Company of New Britain, Conn.; 62 of their arc lights are used to illuminate the main hall, and a portion of the gallery, and the East art gallery. This room has a ceiling of frosted glass, the lights being in the space above, so that the light in the room below is softened and well diffused, bringing out the colors on the paintings in a satisfactory manner.

The dynamos of this machine are provided with a regulator, which adjusts the brushes on the machine and preserves a current of constant electro-motive force to each lamp, so that the lamps can be lighted or switched out at will, the power consumed by the dynamos being proportional to the number of lights in use. These dynamos are driven by a Hawkins high-speed engine.

The Edison Company, for isolated lighting, have an extensive plant capable of supplying over 700 incandescent lights of 16-candle power each.

Four dynamo-machines are running in multiple arc, and the main conductors consist of copper segments inclosed in iron tubes, similar to the electric underground mains of the Edison Company in the streets of New York.

The West art gallery at the fair is modeled after that of the Boston Art Club; but, instead of 375 four-feet gas burners, it is illuminated with 136 electric lights. It is stated this is the first satisfactory exhibit of paintings by artificial light. The remainder of the Edison lights are used to light the exhibit of black and white (crayons, etc.) pictures, the restaurant, the Grocers' Department and elsewhere.



IMPROVED 10-INCH HAND LATHE.

The design of some of the electroliers is very unique. The Edison dynamos are driven by two Lawrence engines in the exhibit of A. F. Upton.

The whole range of exhibits in this fair is a broad and interesting one.

This Institute was formed for the purpose of stimulating business enterprise, bringing the buyer and seller into more intimate connection.

The articles exhibited cover a wide range of iron and wood-working machinery in operation. Machinery for the manufacture of leather, paper and cloth, in great detail. Southern productions are shown by exhibits similar to those at the Atlanta Cotton Exposition. Manufacturing supplies of all kinds are shown; also house-furnishings, including a fine art exhibit. In short, this exhibition presents attractions to the general visitors, and is of especial value to those engaged in manufacturing or commercial affairs.

Grinding Attachment for Upright Self-Feeding Drill.

One of the indispensable adjuncts to a drill-press is a grindstone or other suitable grinding device, for the purpose of sharpening drills. A grindstone is one of the most difficult appliances to keep in proper order for grinding drills, more especially when blacksmiths and others are in the habit of using it for grinding cold chisels, hot-chisels and other promiscuous, rough tools. With a grindstone having a rough or uneven face, it is a very difficult operation to grind a drill, so that the edges will form precisely equal angles with the center line, and also be of exact lengths. These may seem rather fine points for some blacksmiths and other workmen, who require only rough holes to answer their purpose; but the fact is, the nearer round and straight a hole is the easier will it be to fit a pin or bolt. In order to drill a hole round and straight, it is absolutely necessary that the drill run true, that the edges be at equal angles with the center line, and of equal length with each other. A grinding device which will accomplish these results has been invented, and applied to the upright self-feeding drill, shown in the engraving presented herewith. It consists of a spindle, with an emery wheel at one end and a rubber-faced pulley at the other. This spindle is held in a frame, pivoted to the wooden support for the drill press, as shown.

The power required for driving the emery wheel is derived by pressing the rubber-faced wheel against the large wheel by means of a thumb screw, thus furnishing any desired power to turn the emery wheel.

An adjustable drill rest is also provided, which may be used in grinding common, as well as twist drills. The drill press here shown has an adjustable crank for fast and slow speeds, and also for an increase and decrease of power. The improved self-feeding device, also shown, is adjustable as may be desired. This press will drill holes from ¼″ to 1″ in diameter. Its length is 44″, and it weighs 130 pounds.

This drill with grinding attachment, as here shown, is furnished by James Beggs & Co., 9 Dey street, New York.

Improved 10-Inch Hand Lathe.

The 10-inch hand lathe represented on this page, is one of the line of tools manufactured by E. E. Garvin & Co., 139-143 Center street, possesses some features which are worthy of special notice.

The lathe is carefully fitted up with a hollow head spindle running in boxes, which have adjustments for wear so arranged as to always preserve the line and central position of the spindle when the wear is taken up. The front box is made of phosphor bronze.

For the spindle steps raw hide is the material used, being so arranged as to resist the thrust of the spindle in both directions. These steps can be adjusted to compensate for wear.

In order to insure a perfectly-balanced, smooth-running head, the cone is turned all over, inside and out.

Along the back of the lathe is a wooden shelf, nine inches wide, running the length of the bed, and is screwed to brackets which project from the top of each leg, making a very convenient arrangement for the reception of tools and such small pieces as would otherwise be laid upon the lathe-bed to the injury of the planed surfaces.

For certain classes of work, the screw of the tail-spindle is replaced by a hand lever, which especially adapts this machine to the rapid manipulation of light work.

A slide rest is made by this firm as an addition to the lathe, which, together with the lever attachment, make this machine a very comprehensive tool for almost any variety of light turning, drilling and other small work.

The countershaft of this machine should run 235 revolutions per minute.

When ready for shipping, this lathe weighs 275 pounds.

The Monkey-Wrench—Universal Tools—Standard Bolts and Nuts—Standard Wrenches.

BY FRANK GLEASON.

There are a great many tools in use in a machine shop that are too handy to serve the best purposes. When the inventor invents, or the builder constructs such tools he devotes too much energy to making something he can describe as universally applicable, and too little to making something that will serve one good purpose. A machinist knows better than most mechanics the utility of a good tool, but at the same time he is worried by an unresistible desire to possess a tool-chest that he can carry in his pocket. If a square isn't square, it is all right if it represents with its varied and various attachments all the tools an individual journeyman ought to possess. No salesman in the country can sell a machinist a prick punch made of one piece of steel and a chisel made of another piece. Make the prick punch one end and the chisel on the other end of the same peice, and a business is guaranteed.

About the most completely abused, and certainly the most extensively used tool around the average machine shop is a monkey-wrench. One of the foremost mechanical writers qualifies a monkey-wrench by the use of the adjective "beastly," and probably uses some in his own shop that will come reasonably near to doing justice to the qualification. The condition repesented by the aforesaid adjective indicates the direction of public *expression* on the subject of monkey-wrenches. You can't find a half dozen machine shops in the country that are run on any other basis than that of a liberal supply of monkey-wrenches, and that fact shows the direction of public *opinion* on the same subject. There is a material difference between public expression and public opinion.

After all, it is easier to abuse a thing on general principles than it is to abuse it specifically or to hunt up extenuating circumstances. The ghosts of all the corners that wear off bolt heads and nuts, furnish too much argument against a monkey-wrench, and it is convenient argument at that. You don't have to go out of the machine shop to find it.

If the argument in favor of a monkey-wrench could be got outside the consideration of its usefulness as an instrument of torture, and to its consideration as a tool, it might be of use to say something in its favor. When you can trace an effect to its logical cause, and fasten the responsibility somewhere, there is always hopes of working a reformation. Even in a machine shop, if bad effect is offset by well-defined causes, energy enough has occasionally been brought to bear in the proper direction to modify results materially. The trouble is, the argument can't be got there.

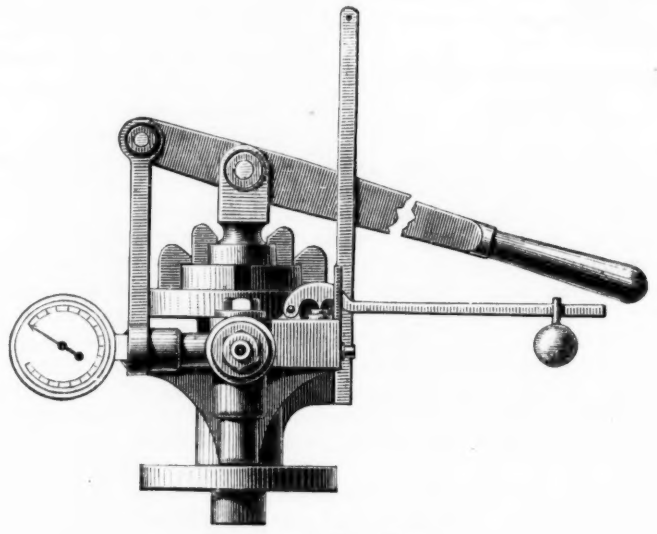
I wonder if it ever occurred to disinterested grumblers that while those that work for the public good—and make monkey-wrenches—may correctly calculate the persuasive effect of a twelve-inch handle, they can't always calculate the effect of the inviting proportions of that handle to facilitate the application of a twenty-four inch length of gas pipe?

When the manufacturer listens to complaints that his particular product, upon which he has expended considerable consideration, gets sprung in the shank, and generally demoralized in the jaws, is he persuaded of an increased development of mechanical muscle, or does he think sadly of the total depravity of the human race mechanical—and the persuasive effect of a three-foot lever?

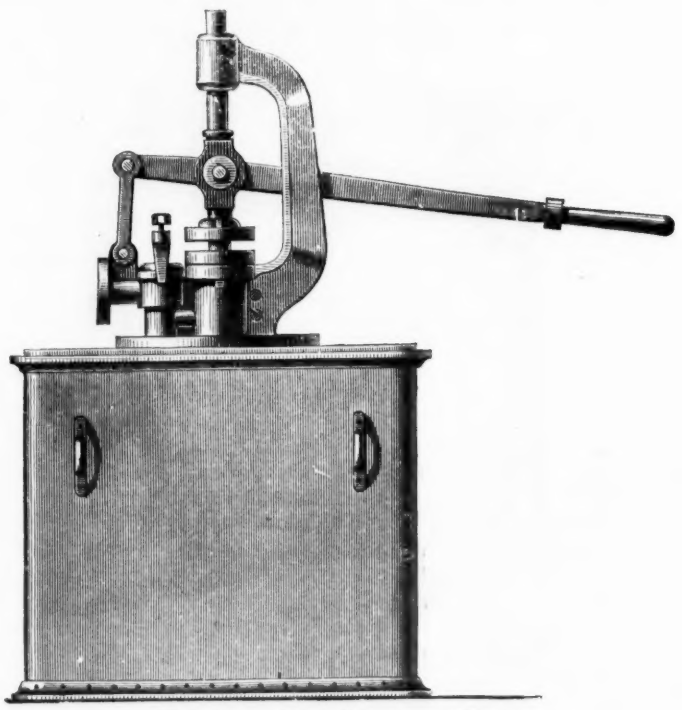
It may not be explainable by any known law, but it is an undisputed fact that there is an affinity between the handle of a monkey-wrench, a dilapidated piece of second-hand gas pipe and a nut that needs a little more urging, that will bring about their ultimate connection and concerted action. Of course the machinist who engineers the union isn't responsible. He isn't a free agent; the connecting link between things that were made to go together. You can't blame the manufacturer, unless it can be demonstrated that he can make the handle of a monkey-wrench of such proportions that the connection is a physical impossibility.

Suppose we put it on the ground that there are certain things a monkey-wrench was never intended for; such for instance as to hammer and to pry with; to elucidate the efficiency of the lever of varied and infinite length; to be used as a wedge, and a shim, and a chock; to be hung on a safety valve lever, and to be put to a hundred demoralizing uses, and particularly to strain at a finished nut with?

If the quality of universal handiness didn't present irresistible invitations to use a monkey-wrench for any and for all these purposes, it might be found to be about as near right as a good many other tools.



HYDRAULIC TEST PUMP.



HYDRAULIC TEST PUMP WITH TANK.

When the representatives of advanced mechanical ideas determined standard sizes for nuts and bolt heads, there seemed to be a prospect that standard wrenches for specific purposes might be used—occasionally. When the same authority decreed that there should be one size for finished and another size for unfinished nuts and bolt heads, the prospect for standard wrenches was materially diminished. But when each individual manufacturer interpreted these sizes, six times in the week, to suit his own convenience, there was no especial object in continuing the fight with standard wrenches. Any particular size was too numerous to make it interesting.

I don't propose to say anything in favor of a monkey-wrench, because it is the proper thing to abuse and use it. I know there are instances of a monkey-wrench holding on when the letting-go wouldn't result in special bodily injury to anyone, but it can't be proved by a solitary machinist that one was ever known to keep its grip when nothing but its doing so stood between destruction and what finger-nails are usually left on a machinist's hand—that is, if the wrench had been sufficiently hammered, and pried, and wedged with to represent the ordinary machine-shop monkey-wrench after about three weeks' use.

Lest some one may imagine that all this shows a covert intention to act up beyond the prerogative of the craft, I will say that, beyond the suspicion of a doubt, when the proprietor, some day, orders me to turn the polished nuts off the steam-chest cover of his engine, I shall reason right up to the morality of the case, spend a half hour—with all hands waiting—looking up the special box-wrench that won't mar the present appearance nor wreck the future utility of the nuts. This wrench will get carefully mislaid, and when the Old Man mildly offers a suggestion in the direction of the improbability of the completion of the job in the near future, I shall kick out of sight my fourteen-inch monkey-wrench that was made to do duty, last week, at the end of a thirty inch extension, borrow Joe's new one, mount the gas-pipe persuader on the handle, and proceed to execute orders—and the nuts.

Will the proprietor object? Not any. He used to do just so himself once, and he knows it is the way to do now. In the end he will look sadly at the places once occupied by the nice corners of the finished nuts, and together we will abuse the monkey-wrench on general principles, while individually I will carefully preserve the persuader for use on the next new monkey-wrench.

I wish some one would devise means of limiting the use of a monkey-wrench, with all its present handiness, to legitimate purposes. I once saw the attempt made in a large establishment, and by a man with a military title at the front of his mechanical appellation. He provided a liberal assortment of hardened standard wrenches, and issued an order that, under certain defined circumstances, the use of a monkey-wrench would be a sufficient cause for the severance of all mechanical relations between the company which he represented and the offending party. The attempt wasn't a success. That military superintendent compassed his own defeat, one day, by engineering a connection between a convenient lever and the handle of a monkey-wrench, in a determined effort to hastily reorganize the shop engine.

There isn't anything to be said in favor of a monkey-wrench. When a machinist uses an ancient representative of one on soft-finished nuts, with the usual results, it is easier to abuse the wrench than it is to blame the man. It is right to abuse the wrench because all precedent is for it. When some one contrives to get six times the destructive energy at work in the jaws of a monkey-wrench that it was ever intended should be let loose there, it is more satisfactory to hold the resulting condition of things up as an example of the normal operation of the tool than it is to investigate further in the line of cause and effect.

Hydraulic Test Pumps.

The engravings presented herewith show some very convenient forms of hydraulic test pumps adapted to various kinds of work. The hydraulic test pump shown in the engraving is intended for all kinds of testing where high pressures are necessary. This pump consists of a brass barrel or cylinder, neatly bored, and having a flange at the bottom for bolting it to a tank or any other suitable support.

A large plunger, $1\frac{1}{2}''$ in diameter, is fitted to the barrel in the usual way, and has leather packings to make a water-tight joint. The large plunger is bored to admit a second plunger $\frac{1}{2}''$ in diameter. This plunger is made of steel and also has leather packing.

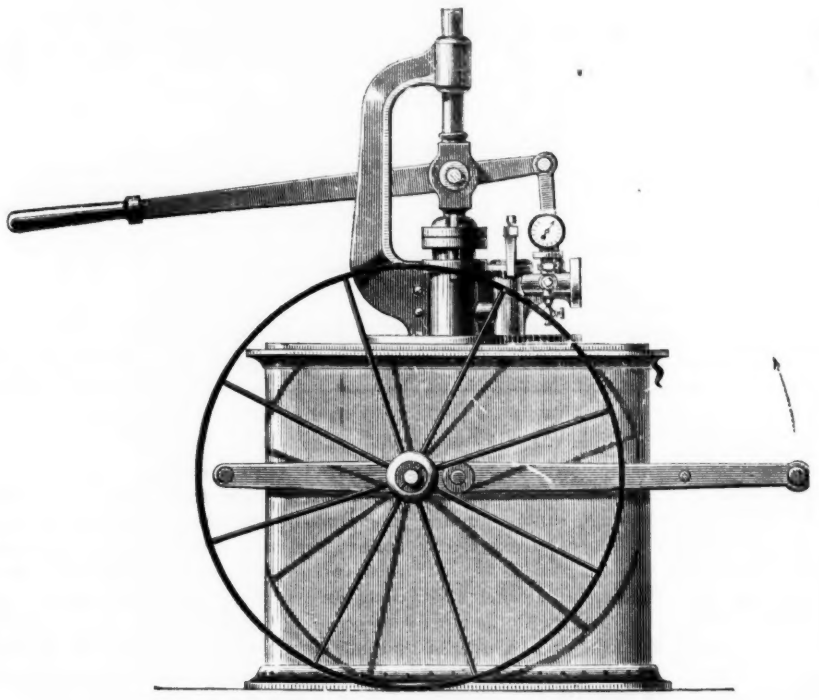
It will be apparent from the engraving that there are two hooks or claws at each side of the two plungers. These claws are of steel, for the purpose of holding the two plungers together while they are used as one, or of holding the larger one fast to the cylinder when the smaller one is used independently. To make this more clear, let us suppose that this pump is attached to a hydraulic press: in starting there is little more work to be done than to raise dead weight and overcome friction, so we turn the large plunger by means of a steel pin so that the two plungers are locked together and use the large plunger alone which throws a great deal of water. As soon as the work increases so that it seems too much for the large plunger the lever is placed in its lowest position, when by the aid of the steel pin mentioned the large plunger is turned so that the lower claws lock it to the cylinder. This movement unlocks the small plunger so that it may be used independently and the pressure can then be readily pumped up to 3,000 pounds to the square inch if desired, which is the limit of this size pump. A hydraulic gauge is attached to the pump, also a safely valve to prevent the accumulation of an excessive pressure. The opening in front of the pump is for making pipe connections either to a press or any article applied to be tested. This pump when desired is mounted upon an iron tank 24′ long, 18″ wide and 24′ deep. This tank is provided with handles for easy transportation, as shown in the engraving. The pump here shown upon the tank, however, is of a little different construction in detail than the one described, but the principal features are the same.

In this pump the small plunger is 1″ in diameter and the large one $2\frac{5}{16}''$, while the limit of pressure allowed for this pump is 750 pounds to the square inch. In place of the steel claws for connecting and disconnecting the plunger, two pins are substituted in place of studs and are screwed fast to the flange upon the large plunger with pro-

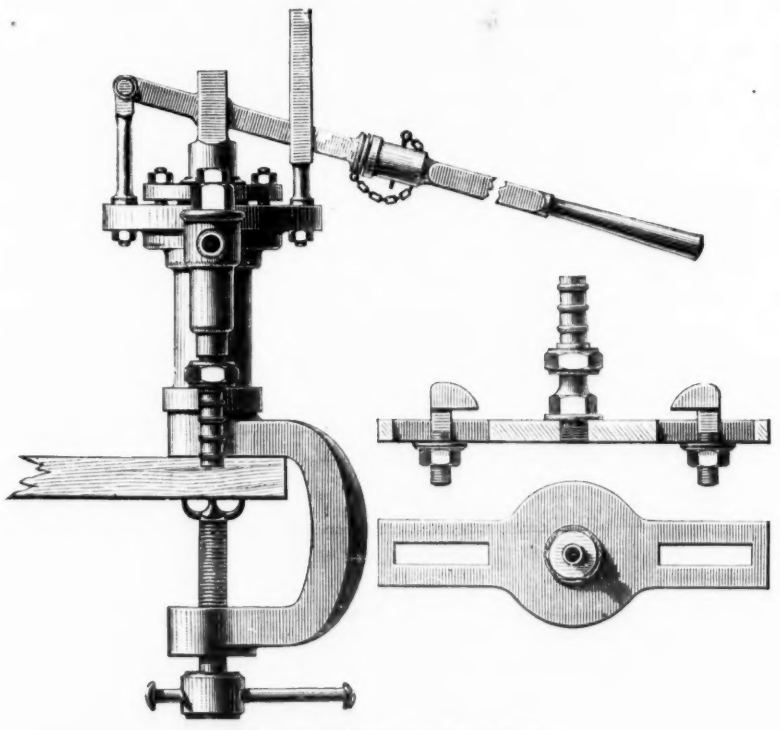
jecting ends both above and below. By throwing the lever down and putting two taper pins through the bottom ends of those already mentioned, the large plunger is held and the smaller one left free, whereas by removing these taper pins and putting them through the top ends of the others above the flanges, the large plunger may be used. This pump is of great convenience in testing boilers. To make this pump still more portable, it is often mounted upon wheels, as shown in the engraving.

When the handle is placed in a horizontal position the tank rests upon the ground, while by throwing the handle up as indicated by the arrow, the weight is transferred to the wheels, so that the whole apparatus may be wheeled about from place to place with great ease. The remaining engraving is that of a small boiler test pump made in such a compact form that it may be packed in a small box or carried in the hand.

This pump has a single plunger 1¼″ in diameter; the barrel is of brass, with a bottom in the form of a clamp, for convenience in attaching it to the edge of a bench, or other similar support. A hose coupling is provided for attaching a hydraulic hose. The handle is made with a socket, so as to be unshipped for convenience in packing. A very handy flange, with hose coupling attached, is furnished with this pump, for making connection with flanges upon boilers or upon pipes. The hooked bolts (which unfortunately the engraver has shown reversed) are intended to hook over the flange, while the slots admit flanges of various diameters. These pumps are made by Schaffer & Budenberg, represented by W. Heuermann, 40 John street, New York.



HYDRAULIC TEST PUMP WITH TANK ON WHEELS.



PORTABLE BOILER TEST PUMP.

A Gravity Passenger Railroad.

Mr. Richard Collins, of Chicago, is the inventor of an elevated railway for use in cities, in which it is proposed to use the force of gravity as a motive power. The road consists of a series of inclined planes and elevators, or lifts. The inventor claims that the public is best served by small cars run at frequent intervals. With the height of lift of elevator, eight feet, he claimed that the length of the inclined plane can be four blocks, and in proportion. The desired speed is obtained by having a steep declivity at first and then lessening the incline to such a degree as to only overcome friction and the resistance of the atmosphere. Manufacturers of elevating machinery declare the plan to be feasible and the cost of constructing and operating small. If hydraulic power is used for the elevators, the cost will be about one-half cent per mile run by the cars; and if steam is used, one cent per mile.

There seems to be but little doubt that a road on this plan would be cheap to build, maintain and operate. How well the speed could be regulated, and how the public would be suited with such a method of locomotion, are matters of opinion which can only be finally determined by experience. We understand that there is a probability that a road on this plan will be built in connection with a new summer resort near Chicago.—*Railway Review.*

Safety Apparatus for Tunnels.

BY J. BURKITT WEBB, CORNELL UNIVERSITY.

In tunneling by means of compressed air, where there is a possibility of the air escaping suddenly and the water entering, a refuge should be provided for the workmen, which should ensure them their lives.

This could be effected by hanging a cylinder boiler in a horizontal position overhead in the tunnel, with an entrance hole in its under side. Into this the men could climb, and, as it would itself remain full of compressed air, no water could enter it. It would need to be advanced from time to time as the tunnel progressed, so as always to be near the workmen, and they could be inside of it in less than a minute after the alarm was given.

The door should be large enough to admit of quick entrance; it should open downward, and should be water-tight when closed. There should be ladders hinged to the boiler to facilitate entering, and which ordinarily would remain hooked up out of the way. An incandescent lamp should be placed inside, and should be always lighted, in order that an entrance might not have to be made in the dark, and there should be also a telephone. In order to provide for an imprisonment of some time, there should be a pipe connecting the boiler with the air compressor, but furnished with a valve on the inside of the boiler, so as to be under the control of the imprisoned. By this means, fresh air could be continually supplied, and by closing the entrance door water-tight the pressure could be let down to that of the atmosphere, and the fresh air supplied at that pressure. In this latter case, a return pipe would be needed for the escape of the air to the surface of the ground; this, however, could be made under the form of a pneumatic dispatch, so that food, etc., could be supplied to the men. Under such conditions, an imprisonment of some days could be endured with little inconvenience.

It does not seem reasonable or human to expect men to risk their lives in a tunnel, when some such simple arrangement might insure their almost absolute safety, inasmuch as the boiler might be entered by swimming, even after the tunnel were full of water.

The total annual value of the iron manufactures of Cincinnati is $21,000,000.

According to the *National Scientific Journal*, a new coking, coal and iron ore district is being opened up in West Virginia, near Morgantown, and a railroad twenty-eight miles long is under way to intersect the Baltimore and Ohio Railroad, near Grafton, West Virginia. The young men of that section have been leaving the lands supposed by them to be sterile and valueless, in order to settle in the West. Now the rich mineral resources that they abandoned so lightly are being uncovered, mainly by Western capital.

A boat to be used for the purpose of a floating sawmill has been built on the river at Nashville, Tenn., for operation on the upper Cumberland. The design of its projectors is to buy pine, cedar and walnut timber on the banks of the river, and to convert it into lumber for market on the vessel, at the rate of several thousand feet per day. The vessel is a novel structure, 100 feet in length and twenty two feet wide, and has a full sawmill equipment.

According to the Denver *Journal of Commerce*, the largest vein of coal in the world has recently been discovered in what was the Ute Indian reservation, Gunnison County, Colorado, 176 miles southwest of Denver. It comprises 1,600 acres of land, and three rail roads are either built or running within a few miles. The coal is semi-bituminous and a jet-black color. It is said to be of excellent quality, almost void of sulphur, and will smelt iron without coking, having been used by miners in the vicinity for dressing their steel drills, and been pronounced by them superior to charcoal for that purpose.

A Novelty in Foundry Practice.

Herr G. Ahlemeyer describes in *Glaser's Anny'en* a new system of melting cast iron, and at the same time incorporating in it scrap, wrought iron, &c. The inventor is Herr Ibruegger, a well-known engineer, who has built one furnace at the Michelbacher Hutte, at Michelbach, Hesse-Nassau, and another at the works of Jules Meyer & Co., at Norden. The cupola is supplied with blast through two sets of tuyeres, one above the other, there being 18 in each set. The tuyeres or ports, which have the form of a vertical slot, are directly connected with a circular tuyere-ring. The particular feature of the cupola is, that the bottom is a slightly inverted arch which is pierced by two openings through which both blast, or rather imperfectly-consumed gases of combustion, and the fluid iron can flow. Below it is a small chamber in which the iron collects. It is heated by the gases forced downward from the cupola above, which are supplied with the necessary air for combustion by a special tuyere leading from the main blast pipe. This chamber at the same time serves for reheating scrap, &c , which need only be pushed into the bath for dissolving it. Of course, it is well known that considerable quantities of scrap can be used by directly charging in any ordinary cupola; but it is claimed that in this case there are economy of fuel and a greater facility in making sharp, strong castings and a purer metal. The best iron for this purpose is said to be inferior pig, like No. 3 Middlesborough, holding considerable silicon and little manganese. To it from 40 to 50 per cent. of scrap, &c., may be added. The total consumption of fuel is stated to be 10 per cent. of the weight of the product.

The Mexican Government is said to be much more careful in inspecting and accepting the new railroads which are now being opened up to travel and business in that country by American capital, than it was at first in promising subventions. The official inspection is reported to be very exacting in the matter of tracks, structures and bridges, and, as a result, the railroads of that country promise to be exceedingly well constructed. In the end, this will be as advantageous to the stockholders as it certainly must be to the general public. If the work of the Commission which this country is about to send to Mexico, with a view to negotiating a reciprocity treaty, comes to anything, the most liberal expectations will be in order, as to the good results that are likely to accrue to both countries in the way of business intercourse and material development.

One of the hopeful indications in the South is the cutting up of the large plantations into small farms. The increase of the number of farms in ten years has been 100 per cent. It is also stated by Southern journals that the diversity of crops in the Southern States will this year exceed any in the history of the past.

An enterprising chap thinks that if Jacob's ladder were now to be placed against the entrance to heaven you couldn't get anybody to ascend it. An opposition elevator would get all the passenger traffic.

The work of the Philadelphia company (Hamilton Disston's) in draining the Florida everglades has been pushed steadily, and it is thought that within three months the canal to Lake Okeechobee will be finished and the reclaimed land put in market.

At Stuttgart, there will be held this year a German bakers' convention. It continues from the 3d to the 6th of September, and is accompanied by an exhibition of machinery and other articles pertaining to the baker's trade.

LETTERS FROM PRACTICAL MEN.

A Recent Boiler Explosion.

Editor American Machinist:

Thinking that a plain statement of the facts in the case of the recent boiler explosion at the car-works in this city, on the 5th of September, would be of interest to the readers of the AMERICAN MACHINIST, I will give them as they appeared to me.

The explosion took place about 8 A. M. The boiler was one which was used for generating steam for kiln-drying lumber and for warming the buildings. It had not been in use before since last March. It was a tubular, five feet diameter and 14 feet long, and had been in use for about 12 years; but 18 months ago the back head and the lower half of rear course were taken out and replaced with new ones. The shell of the boiler was $\frac{3}{8}$″ thick; heads, $\frac{1}{2}$″. The new head was $\frac{7}{16}$″, and the new half course $\frac{5}{16}$″ thick. The boiler stood nearly north and south, with furnace to the south. The main part of boiler—that is, all but the last course and head—was thrown about twenty-five feet to the south, and turned nearly at right angles with former position—front head to the east. The rear course, with parts of head attached, was thrown some thirty-five feet to the east, and nearly flattened out straight. The head was broken into a large number of pieces, varying from a piece 3″ × 7″ to a piece about one-third of the whole head. A part still remains in position among the tubes, and a piece was held by two stay-bolts, which were the whole length of boiler and passed through front head. The other stays were torn from shell of boiler. The seam around the head was broken at line of rivets throughout nearly the whole circumference, except for about 15″, where the break was, perhaps a half inch inside the rivets. This was also true of the seam at the other edge of the course. The longitudinal seam on right side of boiler was not broken, but this course was broken across just inside the rivets in the $\frac{5}{16}$″ sheet. These seams were single riveted in the new course, while in the old boiler they are double riveted. The tubes, with the exception of some six or eight, remained in position in front head, and the old part of boiler appears to be uninjured.

The superintendent of the works was in the boiler room only a few moments before the explosion, and states that there were two full gauges of water, as shown by glass gauge, and only 65 lbs. of steam. They had a low-water whistle, indicating when water was below a line four inches above the top of tubes.

They were using steam to drive a syphon pump, or ejector, to clear a well for the purpose of deepening it. They had been using it only a few minutes, when the foreman of machine shop went to have the steam partly turned off, and was just at the rear of the boiler outside of the building when the explosion took place, killing him and the fireman instantly.

It was evident that there was too much pressure for the strength of the boiler, or that the boiler was too weak for the ordinary pressure used.

There is a large number of people here who are inclined to regard this as a case of "mystery," but the mystery is, that this boiler had stood and done its work as long as it had. An examination shows that a great majority of the rivets in the repair work did not fit the holes, and the holes did not agree, sometimes varying over $\frac{1}{8}$″ In examining one of the circular lines of rivets, I found that out of twenty-five, only five could be said to fairly fill the holes, and in some cases the rivets were very loose; again, in most cases there was not stock enough to make good decent heads upon the rivets. The broken condition of the back head shows a weakness of material, and one of the pieces shows signs of overheating in flanging. This is a plain statement of facts as they appeared upon examination, within two hours after the explosion. I will leave comment to the coroner's jury, which has the matter under investigation.

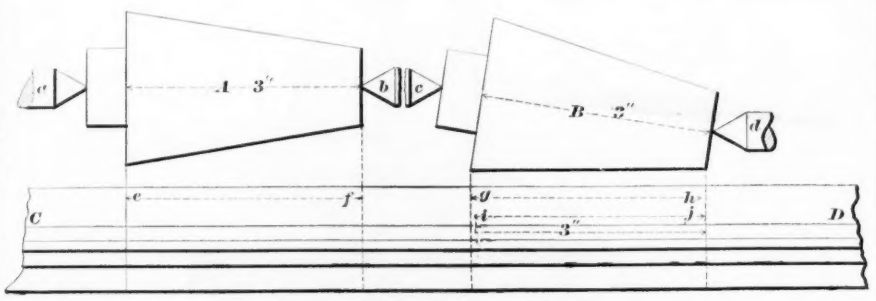
Erie, Pa. C. C. COLLINS.

Cutting Taper Taps in Lathes.

Editor American Machinist:

Several of us machinists have had a discussion on cutting taper taps and screws in a lathe, and I would like to ask your opinion, as well as that of the expert readers and correspondents of the AMERICAN MACHINIST, as a means of settling the difficulty.

It seems to me, that no taper screw or tap cut upon a lathe, set to cut 12 threads to the inch upon a taper, can be precisely 12 threads to the inch; and that 12 revolutions of the spindle will carry the tool forward less than one inch, measuring upon the surface of the taper. The lathe is understood to be set by drawing over the tail center. I maintain that the center should not be drawn over, but that a taper attachment should be used and that the pitch of the thread should be measured upon the center line. Under the circumstances, my opponent says: "No taper tap or screw can be made to measure 12 threads to the inch, and that neither a scale nor screw pitch gauge can be applied to its surface which will measure exactly 12 threads to the inch.



CUTTING TAPER TAPS IN LATHES.

Referring to the accompanying sketch, *A* and *B* show two taps 3″ long, with the taper greatly exaggerated; *A* being in a taper attachment lathe, with the centers *a* and *b* parallel with lathe shear *C*, *D*, and the lathe gears set up for 12 threads to the inch. The whole length *e*, *f* will have 36 threads; while tap *B* is placed in a lathe with center *d* set over to bring the surface parallel to shears *C*, *D*. Then 36 revolutions of the live spindle will draw the carriage the distance *i j*, 3″, which is not the whole length of the surface *g*, *h* of the tap.

In conclusion, I think, as stated in my argument, that the lead of a taper screw or tap should be measured on its center line and not on the surface; therefore it should be cut in a taper attachment lathe.

Am I right? Is there any standard in regard to the matter?

Bridgeport, Ct. ARTHUR E. JOHNSON.

Adjustable Reamer.

Editor American Machinist:

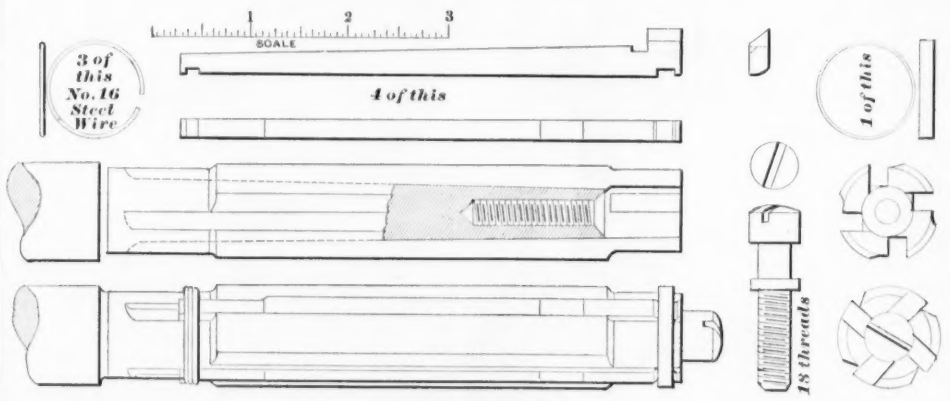
As some of the readers of the AMERICAN MACHINIST are liable to find themselves in the same predicament that I was lately placed in, by having to ream a number of holes so as to make a driving fit for cold rolled iron, they will then, if never before, fully realize the value and practical use of an adjustable reamer.

By the aid of the accompanying sketches I will describe a reamer which I made and used to accomplish the purpose above mentioned. The reader will readily understand the construction of this tool from the sketches.

The cutters, four in number, are made to slide easily into the beveled ways made for them in the body of the reamer. They are compelled to move simultaneously by the end of each cutter fitting into the groove in the adjusting screw, as shown. This screw is tapped into the end of the reamer body, and is counterbored deeply enough to let the head come flush with the end of the body, when screwed clear in. The ends of the cutters should, of course, be neatly fitted to the groove in the end of screw. To hold the cutters firmly to a bearing upon the bottom of the ways, and to prevent them from dropping out, when the tool is laid down upon the bench, a solid, thin, steel ring, spring tempered, is placed over the ends of the cutters next the screw. This ring will flatten somewhat between the cutters, when the cutters are expanded, and return to its original circular shape when the cutters are contracted. In the reamer here shown, the expansion in the diameter was about $\frac{1}{50}$.″ The other ends of the cutters were held by three coils of steel wire, without uniting their ends, each coil forming a separate piece. After each piece is fitted, and the reamer is all complete, it will be found quite a trick to put it together; but if the work has been done in a first-class manner, the task will finally be accomplished satisfactorily. To the best of my knowledge, this tool has never been tied to a patent; therefore, the craft are at liberty to make and use as many as they like.

CHARLES S. BEACH.

Hoosac Falls, N. Y.



ADJUSTABLE REAMER.

Hash Dissected—Heating and Overheating Steel.

Editor American Machinist:

"Mechanical hash" is good, but like veritable boarding-house hash, there seems to be a chance for doubts as to just what it contains. Are we expected to infer that those old mechanics of twenty five or thirty years ago *were* better workmen at that time than the men *are* who build the kind of machinery demanded at present? That some of the old-time workmen who look like men of from forty-five to sixty years of age (*i. e.*, through spectacles), who have kept in the harness and been willing to keep up with the improvements in machinery and methods are still very valuable in our best shops is undoubtedly true; but they are not spending their time in bemoaning the inefficiency of modern machinery and machinists, nor telling us how vastly superior the cold-chisel and file are to planers and shapers for producing plane surfaces. The fact is, a class of work is being done to-day, and must be done to meet the requirements of the times, which calls for an accuracy of workmanship rarely found among the Rip Van Winkles who have suddenly awakened to the fact that it is no longer considered necessary to use square-lathe centers, drill-shanks, or shafting.

Why will this class of men persist in remaining blind to the fact that thousands of different necessary articles of daily use which were formerly *built* or *made* singly by the machinist or other mechanic, are to-day *manufactured* at a mere fraction of the old-time cost, and of vastly better quality? No, no, do not let us discourage the apprentice, nor insult the jour. machinist by belittling the opportunities of one nor capacity of the other, but rather let us congratulate them on the wonderful advantages for learning and improvement which are enjoyed by them as compared with those of earlier days.

It is true that we have a class of so-called machinists who do no decent work, whose round, true, level, square and straight always have to be touched up a little—and whose fits are never just right—always too tight or too loose—too long or too short—too wide or too narrow, a continuation of making something go that is not right, sometimes hiding bad work from the foreman, at others tiring him into accepting it because he knows it is the best the poor fellow can do, and always with an excuse or explanation ready. If one of these men is to fit and drive a stud to a shoulder and have it project a certain distance from the face of the casting into which it is driven, and you tell him when he presents the job as finished that it projects too much, he will look you square in the eye and "guess it is not quite down to the shoulder," while if it does not project quite enough he tells you just as readily that "it *was* exactly the right length from shoulder to end, it must have driven into the casting." But there have always been this kind of mechanics, and, strange to say, many of them have "learned trades"—had all the advantages of a regular apprenticeship in good shops—been jours for years—growled because some young man with a shop experience of a few months is given better work and paid more wages than themselves; they are the most unfortunate creatures; except their employers or the customers who get the vile work produced by them. But what good will come of talking about these out-of-place individuals? In most cases they are conspicuously out of place. Good farmers, lawyers, doctors, preachers, and statesmen they might have made, but never machinists.

A word about steel and I have done, In spite of the apparent intention of the author of "Hash" to have his readers adopt the plan of heating the teeth of taps, reams, cutters, etc., to a greater degree than that at which they should be dipped for the purpose of allowing them to cool down to the proper heat before dipping, I have to say that heating a piece of steel for hardening above the proper heat will injure it. In the case of taps, dies, reamers and cutters it is the teeth which we want kept in best possible condition, as they alone do the work; still we are told that it is best to heat them sufficiently to seriously injure their qualities both for cutting and tenacity, for the sake of properly hardening the body of the tool which does no work except as a holder for the real tools, the teeth. It is not necessary "to keep all parts of an equal temperature while being heated," *but to get the best results it is necessary to have no part of a piece of steel, especially the parts which are to do the work as cutting tools at any time during the process of heating for hardening too hot. Allowing to cool down before dipping will not undo the mischief.* Too hot fires, too much blast, too much hurry, heating too quickly, failing to turn the steel in the fire so as to expose all sides alike,—these are among the most common difficulties. It is not always the case that the teeth of the taps crack in hardening by too great heat, breaking in use does not prove that, for if heated too hot the steel will become as weak, and almost as coarse as cast iron, while hardening at the right heat—and in cold water at that—will make steel much stronger than before hardening.

Waterbury, Conn. S. W. GOODYEAR.

Improved Counter-Bore.

Editor American Machinist:

The accompanying sketch represents a counter-bore, which I made a short time ago, and which in principle is similar to that shown by Mr. Landis in the AMERICAN MACHINIST of Sept. 2, 1882. As I think it is simpler and more easily made than the one mentioned above, I give it, feeling assured that the user will find it a useful and convenient tool. I use, as shown, a right-hand thread for nut to hold the cutter down, instead of a left-hand, and make the cutter a neat fit in the mortise, so there is no danger of the cutter moving to start the nut loose. To prevent the cutters moving out of the mortise, I plane or file each side of the stock flat, about the width of mortise, and ¼" lower down, cutting away the cutter, as shown, so it will fit the stock neatly on the sides. This firmly secures the cutter, and prevents it from working out and increasing the size of the hole. The accuracy of the tool depends in a great measure upon the manner in which the cutters are fitted. For a jam nut, I use an ordinary hexagon nut, with the corners turned off about half its thickness, and the thread chamfered on the inside to prevent bruising. This I think preferable, on account of its allowing the free use of the monkey-wrench, a wrench made for this particular purpose being not always at hand. The principle features of this device are applicable to counter-bores of any size, as well as to boring bars, and I think will be readily understood from the sketch. W. H. DRUCKEMILLER.

Sunbury, Pa.

Shapes of Teeth for Taps and Reamers.

Editor American Machinist:

Very strange notions sometimes prevail among mechanics—even among the best workmen—about things upon which it would seem they ought to be well informed.

In cutting the teeth in a tap, reamer, mill or die, there are many workmen who believe there is a great advantage gained or lost by cutting the teeth forward or back from the center, as the case may be, or by slanting them away from the work, or made "hooking."

For instance, in the diagram, which represents a die, *A*, *B*, *C* represents a tooth cut ahead of the center. Now if the face of the lip be carried back to *F*, *G*, many workmen will say that it has been put on the center, while the fact is that it is hooking. If the line of the face of the tooth be carried out, it will come ahead of the center at *O*, the distance being *E*, *O*.

The die being circular, the position of a tooth as to the center is only a means of determining or expressing the angle its face forms with the work, and, of course, the shape of the tooth depends upon such angle.

Athol, Mass. EDGAR E. O'DANIELS.

Some Mechanical Definitions.

Editor American Machinist:

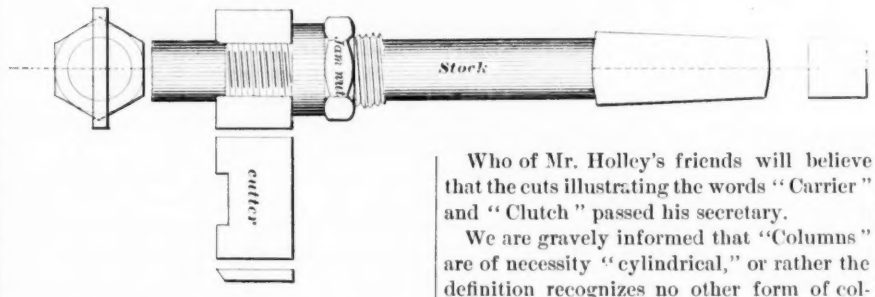
I have read with much interest in your issue of Sept. 16th a review of "Knight's New American Mechanical Dictionary." Never having seen a copy of the work under review (the supplementary volume), I have no disposition to call in question your general conclusions relative thereto, but I cannot avoid taking exceptions to your commendation of the mechanical definitions of Webster's Unabridged Dictionary, which are far, very far, from being "models of terseness, accuracy and perspicuity; and I cannot but think you are mistaken when you attribute their authorship to the "late Alexander L. Holley," for it seems impossible that he had any active part, even in suggesting, so many absurdly erroneous definitions of mechanical terms, appliances and processes, as are found in what its publishers assert to be in "all respects a complete work of reference," and as evidence that my strictures are not too severe, I append a few samples, as the result of a very cursory examination of the way words and things are defined and described therein.

"Abbey," is illustrated by a cut of the "*porch* of Dunfermline Abbey," which bears about the same relation to the whole structure as a back cellar door does to the whole of a dwelling house.

"Air-gun," is described and illustrated in such manner as conveys no correct idea of the construction or appearance of a modern arm of the kind; and on the same page, "Air-pump," is illustrated by a cut of a form of pump that was regarded as old-fashioned and worthless forty years ago.

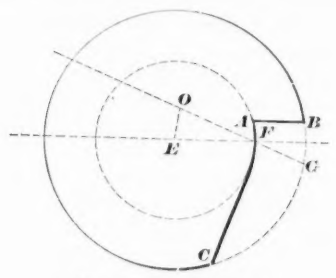
"Awning," is defined as, "A cover of canvas, to shelter from the sun's rays,"—just what kind of an idea a person who had never seen an "awning" would get from this kind of "perspicuity" is what "no feller can find out," he might conclude it was some kind of a canvas umbrella, a tent, or possibly a canvas tarpaulin. The definition entirely ignores the fact that awnings are often made of wood, or corrugated iron, and are as useful as a protection from rain as from sun.

"Back-piece," is illustrated by a cut of



the entire cuirass (of which it is but the back part) and the same cut is made to do duty again as an illustration of the word "Cuirass,"—surely no one who knew the author of "Ordnance and Armor," would accuse him of not knowing half a "cuirass" from a whole one.

"Bar-iron" we are told is "Iron in long pieces, hammered or rolled out of puddle balls, which have been made out of pigs in a puddling furnace or forge." Such "terseness" as this is enough to make the very "pigs" themselves squeal with rage, as it cuts them off from all relationship to "bar-iron" made direct from the ore. Is it not absurd to suppose that "the late Alexander



SHAPES OF TEETH.

L. Holley," who was the recognized champion of various "direct processes," was the authority for such a definition as this?

The word "Bolt," is illustrated with such "model accuracy" that the "wayfaring man" in search of information relative thereto would be both foolish and in error if he accepted in good faith the idea of a "carriage bolt" conveyed by the cut with that title.

The "Bramah lock," we are informed, is "a lock peculiarly difficult to pick, invented by a *Mr. Bramah*, of London." This is another good chunk of "accuracy," but nevertheless far from being a fact, as the "Bramah lock" was picked in the year 1851, by A. C. Hobbs, Esq., then an American exhibitor of locks at the Crystal Palace; it has been repeatedly picked since, and its vulnerable character is so well known that it is not now used, and it has not been manufactured for a number of years. It is simply impossible that the late A. L. Holley, a leading engineer, and frequent visitor to England, should have been ignorant of the "lock controversy," as the discussion resulting from the picking of the "Bramah lock" was called, and have permitted such a definition to escape his expunging hand; neither is it credible that he would have allowed such a ridiculous construction, as is shown in the illustration of the word "Buffer," to pass unchalenged; a construction unfitted by its mechanical imperfections for a "baby carriage," we are asked to accept as the "Buffer" of a "railway carriage;" the author of "European Railway Practice" knew better than to approve of such an illustration.

The etymology of the word "Bush" is entirely wrong, for as regards its mechanical signification the word is derived from the French *bouche* (a mouth), and not from any word in any language that means "shrub" or "woods."

The sixth definition of "Bull's-eye" tells us that it is "a policeman's lantern, with a thick glass *reflector* on *one side*" (the italics are mine). This is given on the authority of "Dickens," and it occurs to me that perhaps the reason why so few midnight prowlers are arrested, is because the police are provided with this kind of "Bull's-eye." Had such a definition been detected by the late Mr. Holley, he would have "played the Dickens" with it without hesitation or reservation.

Who of Mr. Holley's friends will believe that the cuts illustrating the words "Carrier" and "Clutch" passed his secretary.

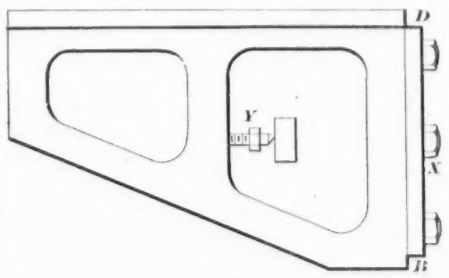
We are gravely informed that "Columns" are of necessity "cylindrical," or rather the definition recognizes no other form of column.

Will any one assert that the "late Alexander L. Holley," who had so much experience with "Cupolas" of the most improved construction would have penned the following singular definition: "The round top of a furnace or the furnace itself," or authorized the insertion of its accompanying illustration, which represents an English "cupola" of the very oldest date, and of which no example can be found in this country; however, whoever is responsible for the insertion of the cut in question manifested a sense of fitness in its selection as it is not one bit more ridiculous than the definition it illustrates.

The definition of "Forcing pump" and its illustrative cut serve only to describe one kind of "forcing pump" and that a very uncommon kind.

The noun "Frame" is said to be "anything composed of parts fitted and united together; a fabric; a structure;"—a hogshead, cooking-stove, or rat trap, must be a frame under this definition;—but, Mr. Editor, I do not believe that you are in a proper "frame of mind" to accept such a definition as an evidence of either "terseness," "accuracy," or "perspicuity" and certainly you cannot believe that the late Alexander S. Holley was its author; neither do I think you will credit him with designing the cut or writing the description thereof, which illustrates the word Gland.

The illustration of the word "Hammock" resembles much more a cow on her back



ANGLE PLATE.

with heels in the air, than the thing defined.

The definition of "Heart wheel," fails entirely to describe the distinctive peculiarity of the reciprocating motion imparted by it.

"Pulley," has an illustration that suggests David's idea of the organization of man, for it is "fearfully and wonderfully made,"—just how the "belt shifter" acts upon the "working belt" *B*, *B*, is a conundrum which I leave for those who are fond of the kind of "accuracy" there delineated.

The cut which we are asked to believe is a representation of a "Rampart gun," is far from being such a "Rampart gun" as the author of "Ordnance and Armor" would have drawn, as it is a ship gun, and I do not believe that a gun on such a carriage as is shown has been fired from behind a "rampart" since the siege of Sebastopol, where such guns were taken from their fleet and used by the Russians to arm their defensive earthworks.

"Reamer." The late Mr. Holley was too good a mechanician to have defined this tool as "an instrument to enlarge a hole in a beveled form."

"Rotary pump," in addition to a very clumsy and imperfect definition, has the illustration "accurately" inverted.

"Scroll" is illustrated by a drawing of something which is not a "scroll," but *is* what is known as the "honeysuckle ornament."

"Semi-circle," has an illustration which is too large *by half*.

"Shell-gun" is certainly not the "shell-gun" of our service, as it resembles more nearly an old-fashioned "68-pounder" on a navy carriage. The late Mr. Holley's knowledge of ordnance would not have permitted such an illustration to go to press.

In the cut of what is called a "Spur-wheel" we have another evidence of a kind of "accuracy," which was certainly *not* Mr. Holley's, the illustration resembles a perspective view of a circular saw, much more than it does a "spur-wheel."

"Telegraph." The instrument shown is not a "Morse telegraph," but a "Morse register" of telegraph messages.

The word "Teem" is *not* obsolete as respects its second definition (to pour) as it is in common daily use in every steel works in this country and England, and no man knew this better than the "late Alexander L. Holley."

"Windlass." The second illustration is not of a "common windlass," but of what is known as a "Chinese windlass," and it is questionable if a single example can be found in use in the country.

I think I have cited instances enough of their error and confusion to satisfy any one who knew the late Alexander L. Holley that he could not have had any connection with the preparation of the Mechanical definitions for Webster's Unabridged Dictionary.

W. F. DURFEE.

Bridgeport, Conn.

Improved Angle Plate.

Editor American Machinist:

In regard to the angle plate described by "F. C. D.," in the AMERICAN MACHINIST of September 9, 1882, I would suggest that the bottom should be made perfectly flat, as shown in the accompanying sketch, and that the edge *D*, *F* should be planed square. Then a straight-edge *X* should be bolted on, so that, when necessary, it may be removed and the plate set at an angle.

The edge may be brought up to the platen by the screw *Y*, acting on a plug. In this way, the plate may be used on any platen, regardless of width.

Madison, Wis. W. B. P

Business Methods Changing.

The method of doing business in this city, says the New York *Sun*, is gradually changing. In wholesale lines the merchants are accommodating themselves to the growing scarcity and increased cost of big stores, and are getting to do business on a finely-furnished floor or in a suite of rooms, where they sell their wares by sample. In these days of telephones and private telegraphs, big warehouses and factories may be situated in the suburbs or out of the city near a shipping point, while the concern's buying and selling may be done in a suite of rooms as effectively by sample as though all of the stock was stored in the place of business. The pleasure and advantage of doing business in a modern well-appointed establishment, instead of in a dingy, poorly lighted, and badly ventilated warehouse, is apparent with trustworthy houses. It is as safe to buy by sample as it is to inspect mountains of goods. The new method makes business easier, and has the further advantage of saving time.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Prest.

JACKSON BAILEY, Vice-Prest.

LYCURGUS B. MOORE, Treas. and Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, F. F. HEMENWAY. } Mechanical Engineers.

The American News Company,

Publishers' Agents, New York.

The International News Company,

11 BOUVERIE STREET, (Fleet St.) LONDON, ENG.

Will receive subscriptions for the AMERICAN MACHINIST at 16/8 per annum, postage prepaid.

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NEW YORK, SEPT. 30, 1882.

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Tariff Reconstruction.

The tariff as a factor in most industrial pursuits, especially in manufacturing enterprises, counts for more than most parties not directly interested are willing to admit. Before our protective tariff was enacted, American manufactures, particularly of iron and other metal goods, were overshadowed by those of foreign countries. Under the tariff they have developed so as not only to hold home markets, but to seriously compete with the manufactures of Europe. The tariff, however, adds nothing to our natural resources for manufacturing, but it has aided wonderfully in their active development. It has led to the breaking up of a number of monopolies of our markets held by foreign manufacturers, and the consequent reduction of prices fifty to two hundred per cent. The sentiment of the country at large is, without doubt, in favor of a continuation of the policy that has proved so advantageous to our productive industries. But the tariff is now open for reconstruction, and the Tariff Commission appointed under an act of Congress is taking evidence upon which to base recommendations for a general revision. So many changes in the articles covered by duties have been made in twenty years that a revision is eminently proper and desirable. While retaining the feature of protection, it must be admitted that a reduction of duties on certain articles would help to secure the "greatest good to the greatest number," which ought to be kept steadily in view in all legislation. What these articles are it will not be difficult for those having authority to act to determine. An active and continuous warfare by free traders has not failed to uncover whatever weak points the present tariff may possess (and no one will claim that it is perfect), until it is an easy matter to mark out its most vulnerable points and take action looking towards a strengthening of them. The work of the Tariff Commission, if it is directed towards an equitable adjustment, need not therefore be so difficult as might appear at first thought. If, however, that body looks only towards pleasing the limited number of individuals who appear before it to give testimony, its work will not be entitled to any very high consideration. The whole decision rests with Congress, and perhaps the main reason why so few avail themselves of the opportunity to be heard before the Commission is because its powers are only advisory. So long as tariff revision is in abeyance (since action must be taken) productive industries will in a measure be restrained, no parties wishing to invest any large amount of capital in new enterprises or in extending old ones that may be disastrously depressed by a change of duties. It is to be hoped, therefore, that the whole matter of revision will be settled before the opening of spring, for the good of business generally. Violent changes are to be deplored as they unsettle commercial affairs. There is reason to believe that most changes will be moderate.

A Railroad Presentation.

We find the following news item in a local paper published in the northern portion of the State of New York.

The Delaware and Hudson Canal Company has decided to extend their Ausable branch railroad from the present station to the Forks. Citizens will furnish the right of way and pay for the grading, about $16,000 to $20,000, and the company will lay the road and operate the same. The distance is about three miles. The extended road will be of great benefit to the business interests of the Forks.

From the information here given it does not appear that the citizens will own any part of the road or receive any portion of the revenues derived from operating it, although paying the greater part of its cost. Did it not occur to the citizens that it would be a good venture to finish the extended road by placing the ties and laying the track, then leasing it to the Canal company to operate? Its "great benefit to the business interests of the Forks," would doubtless have insured traffic enough to induce the Canal company to pay something for using the branch road. Then if the citizens wished to contribute a few thousand dollars for home business improvements they could insure the locating of a live manufacturing establishment at the Forks.

Astonishing Steam Engine Accident.

"This forenoon" (September 7, 1882), says an associated press dispatch, "the collar on the engine of the new Border City Mills, Fall River, Mass., broke while the engine was running, and the shaft was driven through the piston-head, causing a damage of several thousand dollars, and necessitating the shutting down of the mills for some time."

It would be a somewhat difficult task to form any conjecture from the above paragraph what could have happened to the engine here mentioned.

Engines of the stationary type, as a rule, wear more than one collar, which are in most instances protected or are located in places where they have so little work to do that there is hardly any possibility of their breaking.

These collars are usually applied to the shafts for the prevention of longitudinal or end movement, and it is not stated which of the collars broke, but the result is something remarkable.

The report says "the shaft was driven through the piston-head." It would seem from this that the collar had something to do with the engine shaft which carries the fly-wheel, for it appears that the breaking of this collar caused "the shaft" to be driven through the piston-head.

We are at a loss to know how the breaking of a collar would cause the shaft, with the fly-wheel and other appliances attached to it, weighing in all several thousand pounds, to be lifted bodily from its bearings, breaking the holding-down bolts, and being turned at right angles fired out of the hub of the fly-wheel, then through the piston-head. This appears to be the most remarkable example of the kind on record, and the manner in which these gyrations are said to have taken place seem to demand an immediate and thorough investigation.

If the dispatch is true, here is an evidence that some "new force," the knowledge of which is confined to a few such individuals as Mr. Keeley, indeed exists, and its violent demonstrations may be looked for at any time. Steam engine shafts are always in danger of being lifted from their bearings and fired through the piston-head unless this new force is thoroughly investigated and the laws that control its actions fully understood. Then some device may doubtless be applied to the shaft which will neutralize this curious and gigantic force, compelling the shaft to remain in its bearings even though the collar should break. It is all important that the new device, whatever it may be, should be applied in such a way that when the collar breaks its apparent intimate relation with the shaft may be interrupted, thus avoiding any extensive damage to the engine. In the press dispatch above, we are informed that the damage amounted to several thousand dollars, besides the delay for "some time" in the starting of the mill.

It would no doubt be the wisest course to employ a competent expert to investigate the causalities and make a full report of the results of such investigation, in order that mill owners and the public may take the proper steps to guard against future freaks of this mysterious force.

A competent expert could easily be found, who, for a reasonable compensation, say a few hundred dollars, would undertake to investigate the causes and effects in a few weeks' time.

By all means let us have an investigation. It is not yet too late.

The Willimantic (Conn.) Linen Company has posted the following notice in its mills: "No person now in the employ of the Willimantic Linen Company will be continued in their service after July 4, 1883, unless they can both read and write. And on and after this date no person will be hired by the company who cannot both read and write."

This is a commendable step on the part of a large manufacturing corporation. There ought to be no excuse for dense ignorance when free schools are conducted in every neighborhood. Those who can neither read nor write, besides being of inferior value to employers are of small value to themselves or to the community at large. No male or female ought to be employed in a shop, mill, or factory until he or she can both read and write. If the example set by the Willimantic Linen Company is to be followed by other establishments of the kind, we may expect to have a greater industrial progress and fewer deadlocks between employers and employed.

Our friend and occasional correspondent, Wm. A. Sweet, of Sweet's Manufacturing Company, Syracuse, New York, is accustomed to rapid revolution in rolling-mill practice, but that is nothing to the manner in which he will have to "run," if he accepts the suggestion of the *Evening Herald* of that city, and allows himself to be nominated for Congress. We have said in one of our issues that sending a few mechanical engineers to Congress would be a good thing for the people of this country to do, and, while we do not know from what political platform Mr. Sweet's running would proceed, as a man and a mechanic his foundations are solid and machinery in good condition, and we therefore wish success to his canvass.

State Tuition for "Business."

New York State has five Normal Schools in which tuition and books are free to all students entered. The design is to furnish competent teachers for the public schools of the State. In the advertisement of the opening of one of these Normal Schools we find the following announcement:—"In connection with the school there is also an Academic department where students may prepare for college or business."

The kind of "business" this institution aims to prepare students for, is not of a mechanical nature. It does not involve much manual labor, nor anything like the grease and grime of the shop. It looks towards a sort of genteel occupation behind a counter or an office desk. It is almost unnecessary to add that there are ten to a hundred applicants for every vacancy of that kind and very meager compensation for most of the occupants of those places. On the other hand there are ten to fifty concerns that want the services of every skillful mechanic who is ready for engagement. Is it for the best interests of the people of New York State that the overcrowded ranks of bookkeepers and salesmen shall be recruited at public expense while not a cent is appropriated to mechanical instruction? Private institutions can impart whatever class of instruction they choose, but we have a right to question the kind of "business" tuition paid for out of the public funds.

Literary Notes.

LETTERING FOR DRAUGHTSMEN. By Wm. A. Lorenz, 55 Garden Street, Hartford, Conn. Heavy cardboard, 30c.

This card bears upon one side examples of alphabetical letters and figures of such a practical form that they may be used by draughtsmen in placing titles, names of parts, with their dimensions in plain figures, upon mechanical drawings. These alphabets have been prepared to aid draughtsmen in adopting a desirable style of work. The letters upon the card are arranged upon cross-section blocks, indicating their various proportions at a glance. Upon the reverse side of the card are given instructions for drawing the letters, and for laying out well-proportioned figures.

HAND-BOOK OF FARM ENGINES FOR 1882. Designed as a practical guide to the selection and management of steam machinery, as applied to agriculture. By C. M. Giddings, M. E. Published by Russell & Company, Massillon, O.

This little book was written and compiled more particularly for the purpose of accompanying each of the agricultural engines made by the firm named above. It contains such practical information as would

generally be considered most valuable for placing in the hands of those who have never been through the practical course to make them engineers. The increase of agricultural steam machinery and the remote parts to which it is sent, necessitates the employment of persons as engineers who are quick to learn and have sufficient genius to enable them after a little instruction to manage a steam engine. Another object of this little book is to instruct those who purchase engines for agricultural purposes to enable them to use better judgment and taste in the proper selection of such machinery, or in other words to tell very nearly what they want.

A. R. Wilson, Lucknow, India, writes us: "I do not know whether No. 1, vol. I, of the AMERICAN MACHINIST is procurable, but I would give a good price for a clean copy."

On Wednesday, September 6, the second annual exhibition fair of the New England Manufacturers' and Mechanics' Institute was formally opened in Boston, Governor Long presiding. Many prominent persons of New England were present, including the Governors of New Hampshire and Rhode Island. The orator of the day was Hon. Edward Atkinson, who presented the labor question in a well-prepared address, which was fully indorsed by a large audience. As is usual on the first day of exhibitions, a number of exhibitors were very much behind with their exhibits, but everything is now in working order, and the number of visitors who are in daily attendance shows how fully the great industrial exhibition is appreciated by the public. A notable feature is that the manufacturers who are exhibiting are making every effort to interest and instruct visitors. The great Southern railroad display is likely to prove an important factor in the success of the exhibition.

On another page we give some notes of special exhibits, and will refer to others as the exhibition progresses.

In answer to Arthur E. Johnson's inquiry on page 6, we would state that the pipe standards used in this country are of arbitrary sizes and were made by Morris Tasker & Co. some years ago. The taper taps are cut by drawing the lathe tail center over, therefore the pitch of thread is cut as he states, viz.: a less surface pitch than if measured upon the center line.

There is a variation of pitch between the taps and dies, but if two or three threads fit in pipe joints it is generally considered sufficient for all practical purposes. We concur with him in his views as expressed in the letter.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(330) E. F. G., Concord, N. H., asks: Does cast iron, when used for a boiler, undergo any change, by which its absorbing and conducting qualities are impaired? *A.*—We are of the opinion that no change of the kind occurs.

(331) J. G. Clyde, N. Y., writes: I am making a pattern for a girder 23 feet long, 12″ wide on top, and 4″ wide on bottom. The spring is 22″. Will the spring be more or less, after it is cast? *A.*—If proper attention is given the casting in the foundry, it should be the same.

(332) L. L. E., Trinidad, Col., asks: 1. What is the horse power of a boiler, 22 feet long and 4 feet diameter, with 4 flues, each 9 ½″ diameter? *A.*—About 25 horse power. 2. How much grate surface should such a boiler have? *A.*—For burning coal, 16 square feet. 3. What is a safe pressure for such a boiler, made from ¼″ iron, longitudinal seams, double riveted? *A.* If of good material and well made, 70 pounds. 4. What is the horse power of an engine, 14″x 28″, running 80 revolutions with 80 pounds boiler pressure? *A.*—About 60 horse power.

(333) B., Brooklyn, N. Y., asks: 1. How can I clean tinned articles? *A.*—Wash with hot water, and clean with a mixture of finely pulverized rotten stone, soft soap and oil of turpentine mixed about as stiff as putty. Mix a little of this with water and rub it over the metal, then rub briskly with a dry clean cloth. 2. How can I clean small brass articles that are very dirty? *A.*—Take very finely rubbed bichromate of potassa, and mix with twice the bulk of sulphuric acid and three times the quantity of soft water. Use this for cleaning, then wash the articles immediately in clean water, and polish with rotten stone.

(334) E. D., Philadelphia, Pa., asks: 1. What should be the dimensions of boiler for yacht ergine, 4″x 4½″? *A.*—34″ diameter and 46″ high will do. 2. How can I calculate the probable speed, with a propeller wheel of 56″ pitch, making 250 revolutions per minute? *A.*—You can calculate this only approximately. You can calculate how fast a screw of that pitch and at that speed would prive your boat, if there was no slip, and deduct the estimated slip, which would probably not be less than 35 per cent. Thus multiplying together 250, 56 and 60, and dividing the product by 12, gives 70,000 feet per hour, if there is no slip. Deducting 35 per cent. of this for slip, leaves 45,500 feet, or about 8 miles an hour.

(335) G. G., Staten Island, asks: Will you please tell me the reason, if there is any, why the circumference of the circle is divided in 360 parts, so as to make one part a degree; why just 360 and no other; also where did the foot measurement come from, and what was the reason for dividing it in twelfths to make one inch? *A.*—There is no especial reason why the circle is divided into 360°, instead of into some other number. It was necessary, or at least advisable, to divide the circle into some number of degrees, and 360 is the number that was hit upon. So with the foot measure, which is obtained by dividing the standard yard into three parts. The inch is the 1-35th part of the yard, and hence 1-12th of a foot, and was established because it was believed to possess the merit of convenience.

(336) W. W. S., Grand Rapids, Mich., writes: I have a cutting machine in which the knife is moved by a foot lever. The motion of the lever is 8″, and the motion of the knife is 1½″. Is there any way I can change this, so as to get a strong motion to the knife and at the same time have the foot treadle move only the same distance as the knife? *A.*—No. If the treadle moves only as fast as the knife, you will get the same weight on the knife that you put on the lever, *less* the friction of the parts. For instance, if you put 100 pounds foot pressure on the lever, you will get perhaps 80 pounds pressure on the knife. You must have the foot treadle move as many times further than the knife moves, as you wish to increase the cutting pressure on the knife over the weight applied to the lever, and enough more besides, to compensate for friction.

(337) J. S. D., Baltimore, Md., asks: Will you do me the favor of informing me as to the custom of steam engine builders in rating the power of steam engines. Whether it is customary to give the actual or the indicated power. For instance, an engine sold as a 4 H.P.; is it understood as an *actual* 4 H.P., or simply an indicated 4 H.P., and if the latter, what is the average percentage chargeable to friction? *A.*—It is the more general custom at the present to rate an engine by actual H P. The friction of engines varies with the size and construction. In small engines of different make, the friction will vary from 10 to 30 per cent.

(338) H. L. B., Augusta, Ga., writes: I have a boiler, similar to those used in steam fire engines, 6′ x 42″ outside shell; 3′ x 38″ inside shell. There are 150 gas-pipe water tubes, each 1″ diameter, screwed into the crown sheet, and about 20 or 24 1¼″ flues. The total heating surface is 160 square feet. What I want to ask is: 1. Can I, by proper management, run a 7″ x 7″ engine at 200 revolutions, doing full work, with this boiler? *A.*—By crowding the boiler you may be able to run. The boiler is, however, rather small, and not very suitable for continuous use. 2. Would the results be better, if I were to use 180 gas-pipe tubes, ¾″ diameter, instead of 150 tubes, 1″ diameter? *A.*—No. 3. At 200 revolutions would not the engine run reasonably steady without fly-wheel? I could make a heavy disc crank. *A.*—You will need considerable fly-wheel, and unless you have room for a very large disc crank, the motion will be unsatisfactory.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

F. Samuelson, Pattern Maker, 38 Gold St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Hoerle Bros., Naugatuck, Conn. Small Dies and Special Tools to order.

J. C. Hoadley, Engineer and Expert, 29 High St., cor. Federal, Boston, Mass.

Howard S. Abbot, Solicitor of Patents, 617 7th St., opposite the Patent Office, Washington, D.C.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

For Sale—A valuable patent, Improved Tack Hammer. For particulars address, R. H., Box 74, Silver Creek, N. Y.

"Steam Economy," 124 pp., cloth, $1.00, by mail, points out remedies for defects in engines. Best indicator practice. A. Wilkinson, 123 n. 4th St. Phila.

Mechanical Engineering.—To learn inventing, designing and construction of machinery at school. Address, S. W. Robinson, Ohio State University, Columbus, O.

"How to Keep Boilers Clean," and other useful information for steam users and engineers. Book sent free by the publisher, Jas. F. Hotchkiss, 84 John street, New York. Mention this paper.

We will pay 25 cents each for copies of the AMERICAN MACHINIST for January 1, 1881, which are clean and in condition for binding. American Machinist Publishing Co., 96 Fulton street, New York.

For Sale—Complete file of Engineering (except several early issues out of print), six volumes bound, remainder unbound. In perfect condition. Address X, Box 2714, New York City.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

Bound Volumes and Patent Binders. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, or Volume 4, containing the 53 issues of 1881, neatly bound in cloth, ready to ship by express, for four dollars. Either volume unbound, three dollars. "Patent Binder" for the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. AMERICAN MACHINIST PUBLISHING Co., 96 Fulton Street, New York.

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Rocks, Minerals and Stocks; by Frederick H. Smith, Consulting Engineer and Geologist. Contents: Part I. World Building, Prime Minerals and Rocks, the Formation; Part II. Gold and Silver, Industrial Metals, Coal and Oil, Industrial Minerals, Precious Stones; Part III. Stock Companies, Stock Dealing, Stock Tricks. *A vade mecum* for the use of everyone interested in these important topics. Scientifically accurate, witty, fascinating. *Sui generis* among technical books. Handsomely bound in cloth, $1.50, in paper, 75 cents. Order through your bookseller, or address The Railway Review, 182-184 Dearborn St., Chicago, Ill.

MANUFACTURES.

The Chicago Malleable Iron Company has increased its capital from $200,000 to $300,000.

A. S. Newcomb & Co., will build a six ton manilla paper mill at High Falls, near Rondout, N. Y.

Bismark, Dakota, offers $25,000 to have the Northern Pacific shops located at that place.

Jordan L. Mott is to erect a new foundry building at the foot of East 134th st., New York, at a cost of $30,000.

The Yantic Paper Company, Greenville, Conn., is thinking of putting in a steam engine to run during the dry season.

The works of the Meriden Frog and Crossing Company, now being built at Chicago, Ill., will, when completed, employ 500 men.

The Smith Suspension Wheel Company are negotiating with a view to the removal of their works from Batavia, to Lockport, N. Y.

The Standard Machinery Company, Mystic River, Conn., has recently shipped a consignment of paper-cutting machines to Australia.

The new Holyoke (Mass.) Foundry Company's buildings are rapidly approaching completion, and the furnaces will be lighted about Oct. 1.

St. Louis is to be supplied with water gas for fuel purposes, made by the Lowe process. The laying of pipe is progressing, with ten miles under contract.

There are said to be 18,000 locomotive engines in use in the United States. Pennsylvania has the largest number, 2,700, while in New England there are but 1,700.

The Dexter Paper Co., Windsor Locks, Conn., are setting a tubular boiler with the Jarvis furnace. They have been using this furnace for four years, under four boilers, and this is the fifth order.

It is stated that Americans prospecting in Northern Mexico have discovered immense coal deposits, that as the country is made orderly by the introduction of railways and American enterprise, will prove of great value.

W. C. Young & Co., Worcester, Mass., manufacturers of lathes and light machinists' tools, write us: We are adding about one-third to our floor space, and expect before long to be able to keep up with our orders.

The Harrison Boiler Works have erected works at Germantown Junction, Philadelphia, Pa, especially for the manufacture of the Harrison boiler. The new works are so situated as to have track facilities with both the Reading and Pennsylvania railroads.

Weisel & Vilter, of the Milwaukee Steam Engine Works, at Milwaukee, have five large Corliss engines under way, besides a number of their plain side valve engines. In addition to this work they build steam pumps, patent grate bars, and machinery for brewers.

J. H. Horne, Lawrence, Mass., manufacturer of paper machinery, has erected a new building, 155x40, into which he will move his business. Power will be furnished by an 80 H. P. engine and boiler. The boiler will be set with the Jarvis furnace to burn screenings for fuel.

The Rome (N. Y.) Spring Wagon Co. has just increased its capital stock from $13,000 to $50,000. The present indebtedness of the company, aside from stock, is $21,145.22 and the assets $40,684.07. C. D. Prescott has been elected president, and Louis Roth secretary and treasurer.

The Turner Feed Water Heater and Condenser, manufactured by the Bass Foundry and Machine Co., of Fort Wayne, Ind., is highly spoken of by local papers and by engineers who have tested its merits. Mr. Turner has completed arrangements for putting his heater in the market.

W. H. Warren, Worcester, Mass., is doing a lively business in building and selling radial drills and shapers of his own design. He has doubled his capacity this year and now has a shop 74x38 feet. He is a thorough and experienced mechanic and is constantly studying out improvements in the tools he manufactures.

The *Northwestern Lumberman* says: The towns of Norwood and Potsdam, in northern New York, should use home capital to organize companies, erect factories, and run a narrow gauge railroad into the heart of the Adirondack woods, on which to bring out the cherry, birch and maple that abound there.

The extensive Glucose Sugar Works, at Leavenworth, Kan., have been purchased by Hamlin & Sons, of Buffalo, N. Y. This firm already controls the bulk of this important business in the United States, and has commenced extensive alterations at the Leavenworth works, for the purpose of increasing the output.

A large meeting was held at Fort Smith, Ark., recently to take steps towards securing the location of the machine shops of the St. Louis & San Francisco road at that point. The company want $30,000, which sum it was docided to raise. A large amount was subscribed, and a committee appointed to raise the full amount.—*Age of Steel.*

The portable house trade is becoming a thing of considerable importance in Canada. The Logan Construction Company owns a patent for such structures, and is beginning operations at Ottawa. Three houses for local use have already been made. The skating rink at that city has been leased, and operations in the new industry will be prosecuted there.

F. B. Allen has resigned as one of the inspectors of the Hartford Boiler Insurance Co., to accept the position of Chief Inspector of the New York Boiler Inspection and Insurance Co., just organized. The new company has a capital of $250,000 and will have a corps of competent inspectors so as to secure business in every part of the country.

John W. Kauffman's flour mills, Bethalto, Ill., recently burnt, had their boiler set with the Jarvis furnace and used slack Illinois coal. It cost for fuel only two cents per barrel to make their flour. Among recent applications of this furnace are settings for two boilers of the Omaha Smelting Co., and for one of the Planter and Porter Paper Mill.

It is not yet settled where the projected shops of the New York, West Shore and Buffalo Railroad (now under construction) will be located, or whether one large shop or two smaller shops will be decided upon. Kingston, Athens and Newburgh are talked of, as also some city like Syracuse, half way between the terminal points of the road. A decision will be reached very soon.

The Tewksbury Automatic Elevator Co., of New York, have an elevator running at the New England Manufacturers' and Mechanics' Institute, Boston, from which they are receiving many orders. They are also putting up machines in New York, and have calls from all parts of the country. They have been obliged to put up an extension to their factory, and contemplate further additions.

We recently made a call at the Leeds Foundry and Machine Works, Gananoque, Canada, and found business quite brisk in those shops. The products are lathes, planers, shapers, boring mills, turbines, presses, pulleys and shafting. Considerable job work is also done. Most of the tools used in the shop were made on the premises. About 30 men are employed in machine shop and foundry.

The Suspension Car-Truck Manufacturing Company, of New York, has decided to locate at Pullman Ill., and will begin building operations at once. Twenty acres of land, lying near the Pullman car shops, have been purchased and permanent works will be erected. Pending the completion of large shops, a portion of the Pullman car shops will be used for the manufacture of car trucks, as it has been decided to commence operations at once. The new works will have facilities for turning out 100 sets of car trucks per day, or 30,000 sets per year, and will give employment to about 100 men.

The Niles Tool Works, Hamilton, O., have recently added a new building, 140x40, to increase their machine shop capacity, to be used specially for boring mill work, and contemplate an addition to their foundry. Their main shop is 400x70, fitted with a fine plant of tools and every convenience for handling heavy work and for saving time. In the tool room the bell enunciator deserves special mention. By its use the workman at any large tool calls one of the boys from the tool room, who checks out to him what is desired, returning it in the same manner. The works employ 300 men, including a night force for the last two years, and manufacture a complete line of machine tools, including a special line of pulley machines, boring machines, and radial presses, all fitted with cut gears. They have orders ahead for one year, and the manager, now in Europe, is sending home additional orders from England, Scotland, Germany and Russia.

Machinists' and Engineers' Supplies.

NEW YORK, Sept. 14, 1882.

The fall trade is slowly increasing and the supply market is in a thoroughly satisfactory condition. All kinds of supplies and tools are to be had within a reasonable time.

Up to the present time the demand for Wrought Iron Pipe has been about the same as last year, while the supply is fully forty per cent. less. Should there be a sudden cold wave there would come a demand for pipe which would quickly clear the market of the small stock now on hand.

Sweetland & Co., manufacturers of the Sweetland chuck, New Haven, Conn., send us the following circular which explains itself:

"The *fire* which occurred in our premises on the 7th inst., will not interfere with our manufacturing department. The losses having been adjusted, we are again in full operation, and you can rely upon your orders being promptly executed."

The rolling mill of the Akron Iron Co., Akron, O., has been enlarged and about $40,000 worth of new machinery added which increases their capacity to produce hot polished shafting about forty per cent.

E. E. Garvin & Co., 139 to 143 Center street, New York, has issued a new illustrated catalogue of 32 pages, containing descriptions with prices of their machine tools and appliances.

The Putnam Tool Co., Fitchburg, Mass., are making ready to manufacture machine tools of new design. They expect to place tools in position for work very soon, and about January 1, 1883, will bring out a new lathe.

Iron and Metal Review.

Nothing new has occurred in the Pig Iron market since our last report, and the same quiet feeling prevails. We quote prices unchanged as follows: Foundry, No. 1, $26 to $26.50; Foundry, No. 2 X, $23.50 to $24; Grey Forge, $20.50 to $21.50. In the Foreign market prices are slightly weaker than last reported. We quote as follows: Coltness, $25.50 to $26; Glengarnock, $23.75 to $24.25; Gartsherrie, $25.50 to $26; Summerlee, $25 50 to $26; Carnbroe, $24; Eglington, $22.50 to $23.25; Langloan, $25.50 to $26; Old rails quiet at $27 for Tees and $30 for double-heads. Wrought iron Scrap $28 to $30. Bar iron is in slow demand at 2.06c. for large lots. Copper is quiet at 18c.; Banca Tin, 28c; Straits and Malacca 25¼c. to 25⅝c.; Billiton, 25c.; Australian, 25½c.; Lead, Common, 5.10c.; Refined, 5.15c.; Antimony, Hallett's 11.; Cookson's, 13; Nevada, 12½. Spelter Common Domestic 5.40c. to 5.60c; Refined, 8c. to 8¾c.; Silesian, 5.45c. to 5.55c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—Situation as Engineer by competent engineer and machinist. Address D, this office.

Wanted—a mechanical draughtsman. Apply to Babcock & Wilcox Co., 30 Cortlandt st., New York.

Wanted—A mechanical draughtsman, competent to work up details. Address, R. D., this office.

Wanted—a situation by a mechanical draughtsman. Address, R. G., AMERICAN MACHINIST office.

A man of experience with steam engines and general jobbing, wants a situation to take charge of work. Correspondence solicited. Address, Box 503, Defiance, O.

Wanted—a position as foreman of machine shop. Thoroughly posted on all kinds of engines and general machine work. Eight years' reference as foreman. Address M. T. G., this office.

A draughtsman of large experience in Rolling Mill, Engine, and general machinery; good designer, thoroughly practical, seeks engagement. First-class references. Address Penna, this office.

Wanted—a mechanical draughtsman; one having had practical experience in general shop work preferred. Address, stating age, experience, references and wages required, Draughtsman, P. O Box 1,485, New York.

Wanted—By a mechanical engineer of means and standing, a position as superintendent, where duties are not laborious physically, or would take an interest financially in a small thriving concern. Address X, Box 2714, New York City.

For Sale—A valuable patent. Address, Mrs. E. Allen, Freeport, Ill.

For Sale! One 80 H P. Root's Sectional Safety Boiler. J. A. Fay & Co., Cincinnati, Ohio.

For Sale—A Richards Indicator with three springs, new and complete. Address Indicator, Box 2, office AMERICAN MACHINIST.

A machinery manufacturing firm desires to buy gear and pulley patterns (stock patterns) either new or second-hand. Address, stating condition and prices, Patterns, care AMERICAN MACHINIST.

Forty-inch Hewes & Phillips screw cutting cross-feed lathe for sale. With raising blocks to swing 52", and 4-jaw chuck. George A. Ohl & Co., East Newark, N. J.

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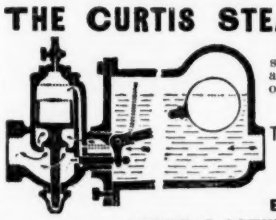
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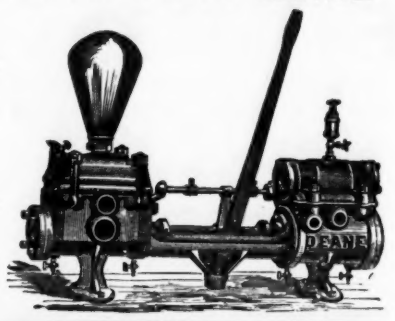
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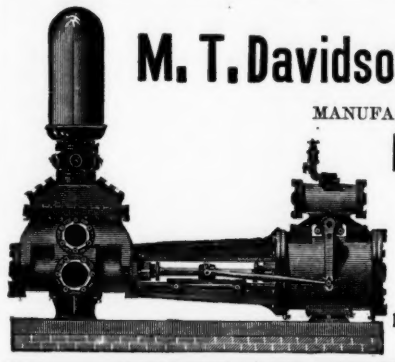
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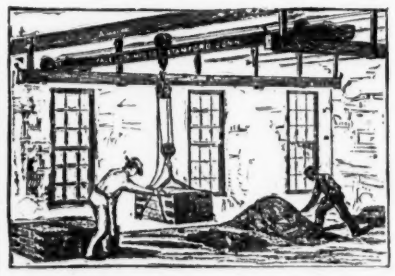
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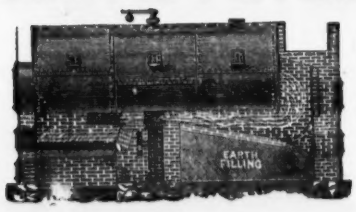
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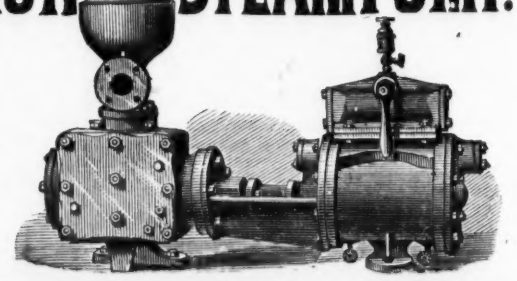

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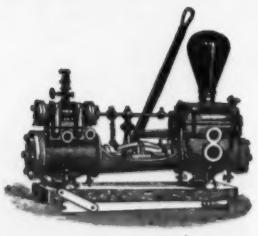
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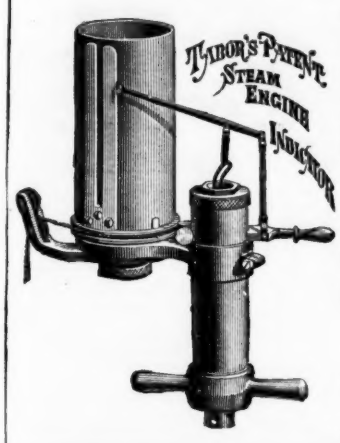

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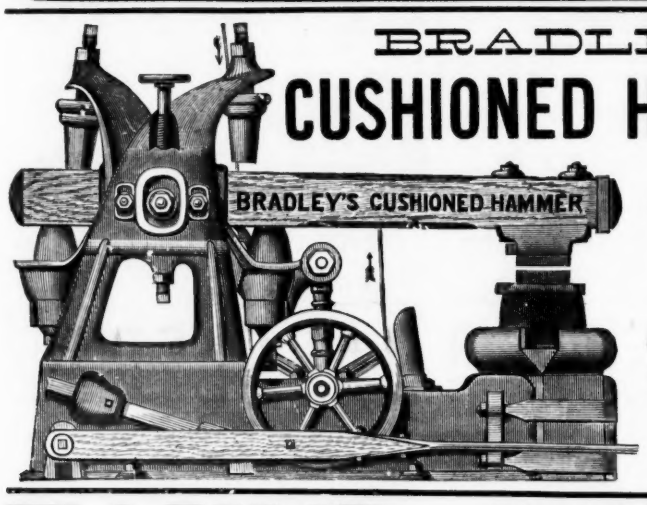

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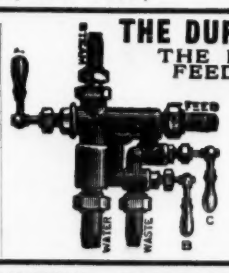

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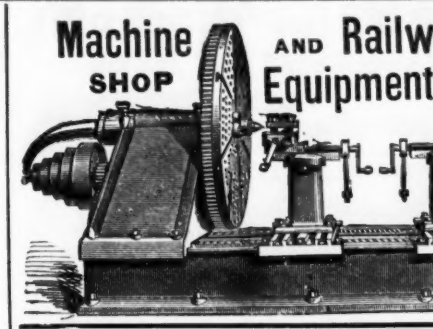

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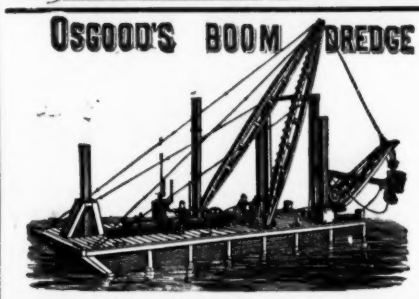

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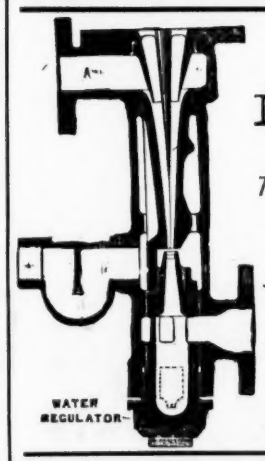

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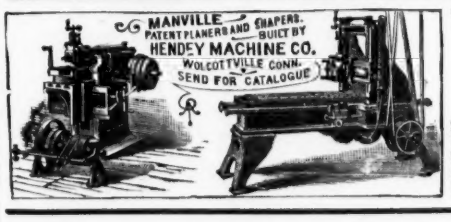

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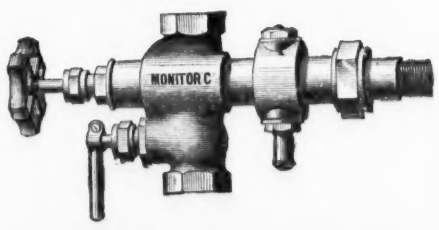

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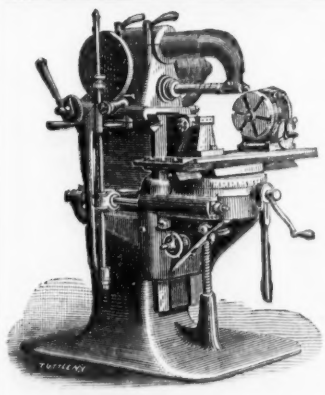

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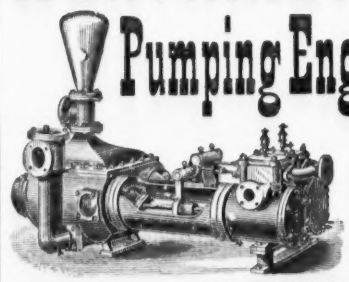

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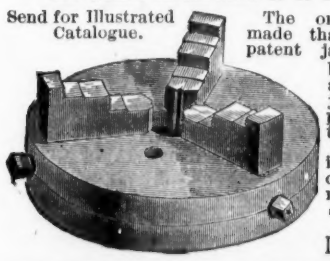

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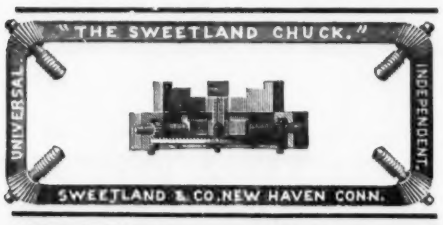

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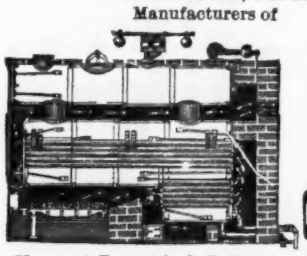

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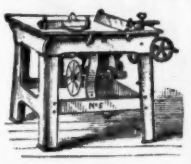

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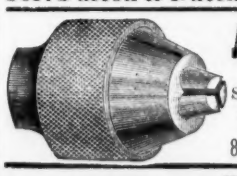

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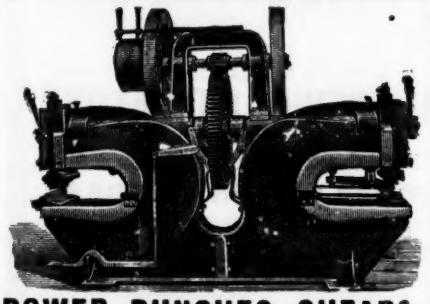

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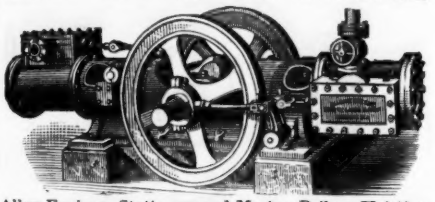

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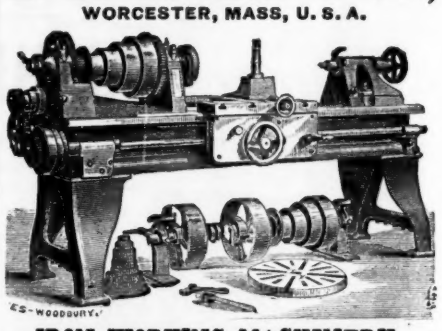

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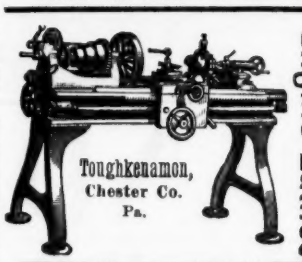

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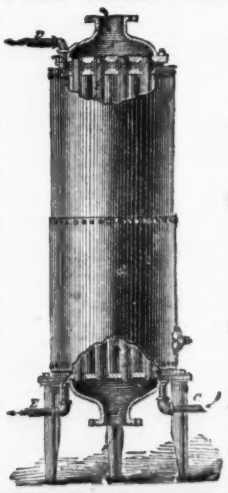

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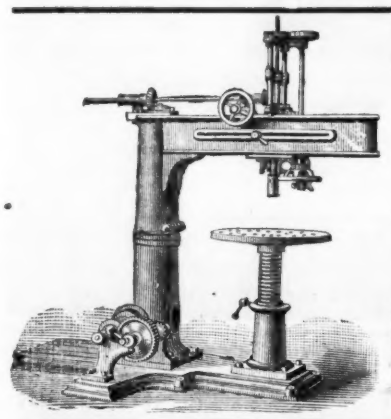

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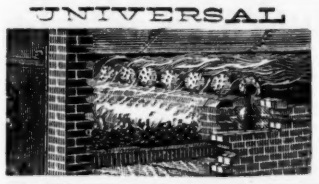

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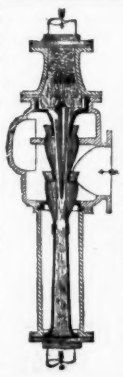

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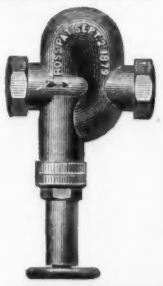

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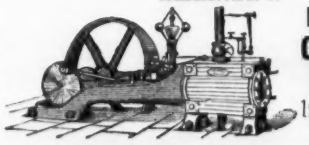

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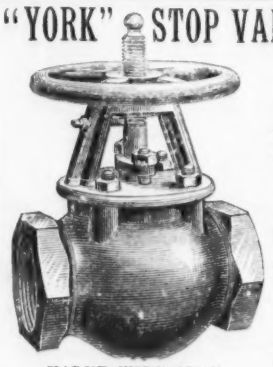

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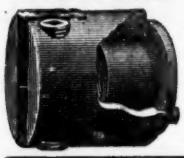

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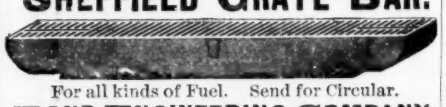

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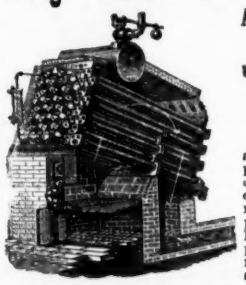

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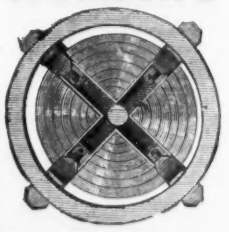

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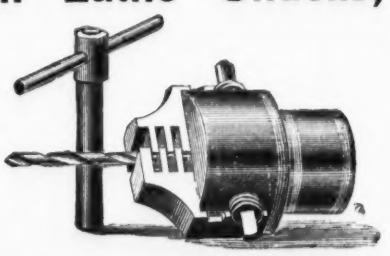

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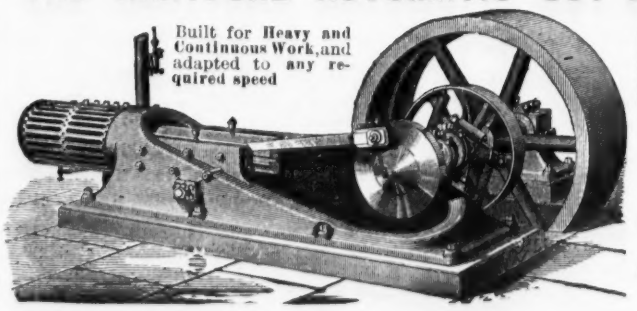

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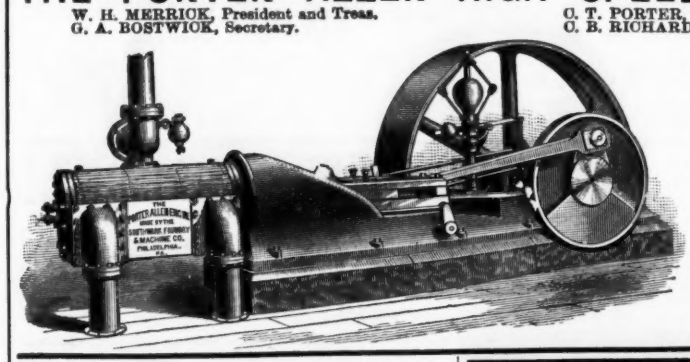

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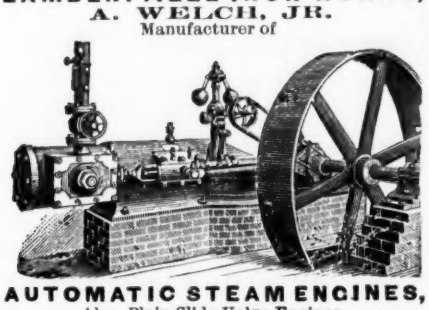

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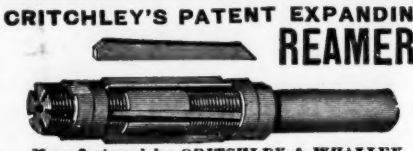

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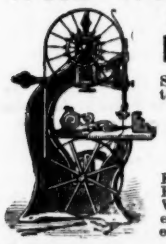

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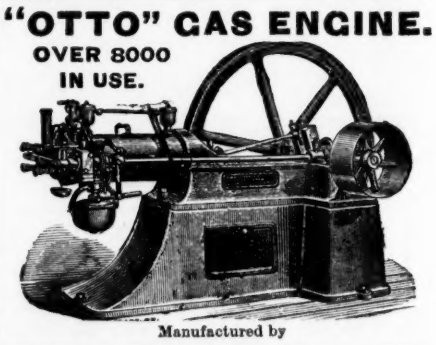

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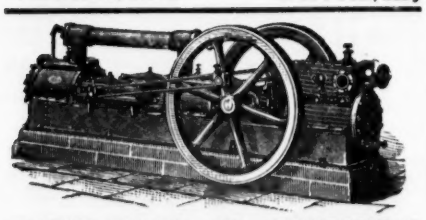

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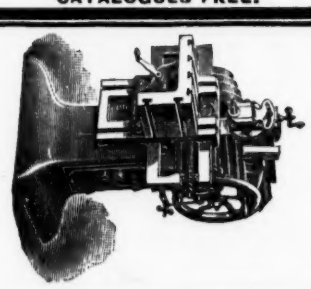

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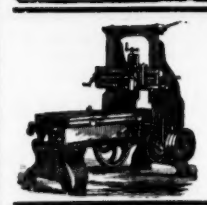

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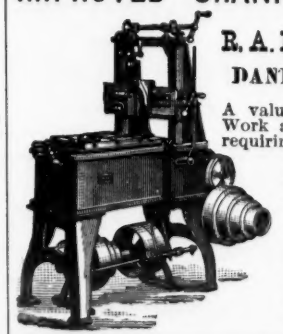

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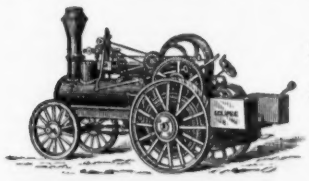

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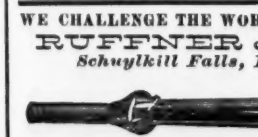

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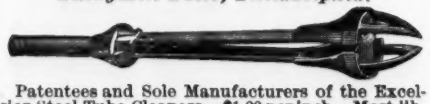

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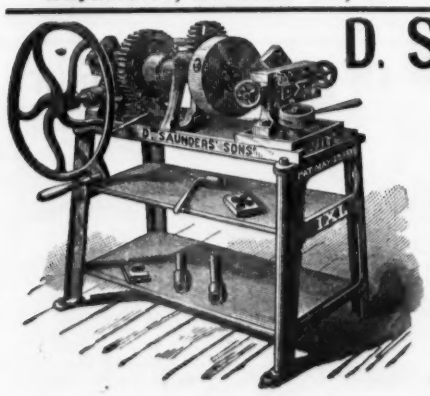

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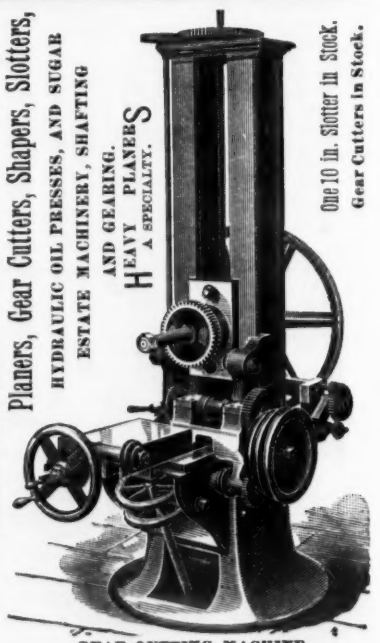

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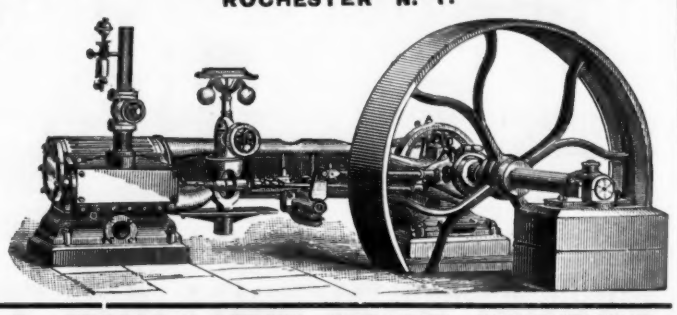

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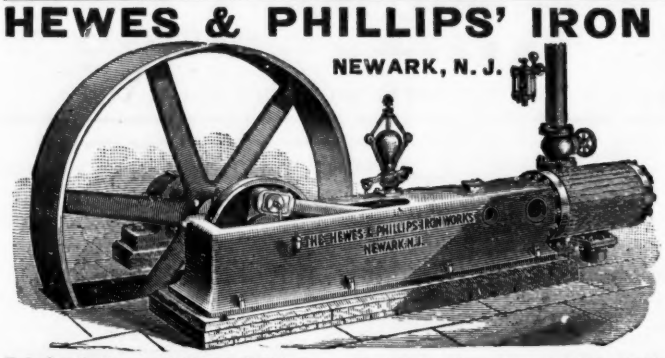

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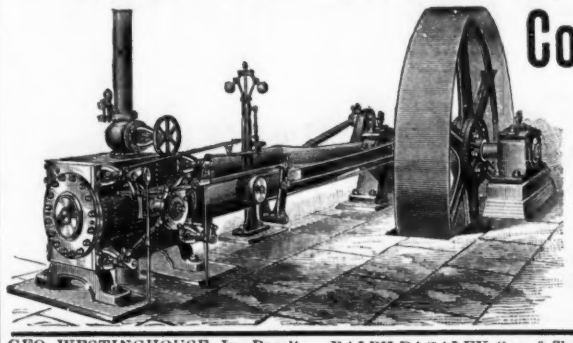

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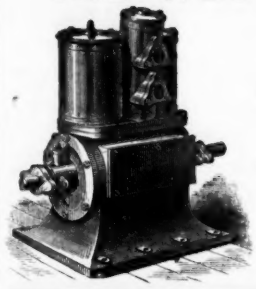

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2	18 in. "	8 ft.	"	"	"
5	15 in. "	6 ft.	"	"	"

1	Square Arbor Fox Lathe. New.
1	12 in. swing, 6 ft. Hand Lathe. New.
1	10 in. " 4½ ft. Bed Hand Lathe. New.
2	30 in. x 8 ft. Planers. New.
1	26 in. x 7 ft. Planer. New.
1	26 in. x 5 ft. " "
1	22 in. x 4 ft. Planer. New.
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1	26 in. Drill. B. G. & S. F. New.
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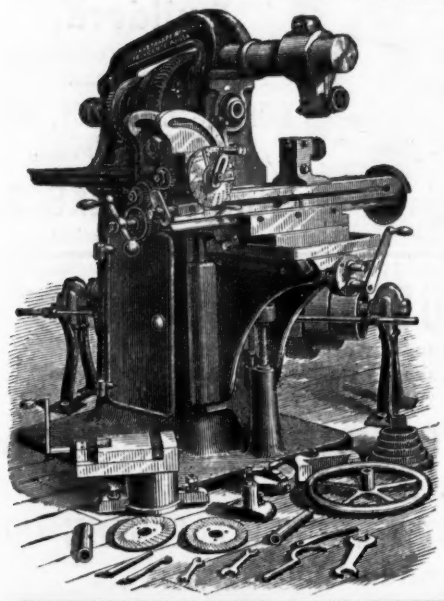

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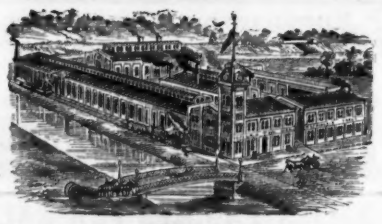

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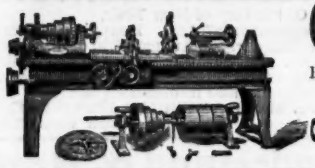

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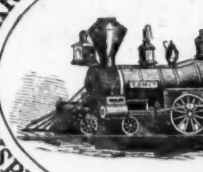

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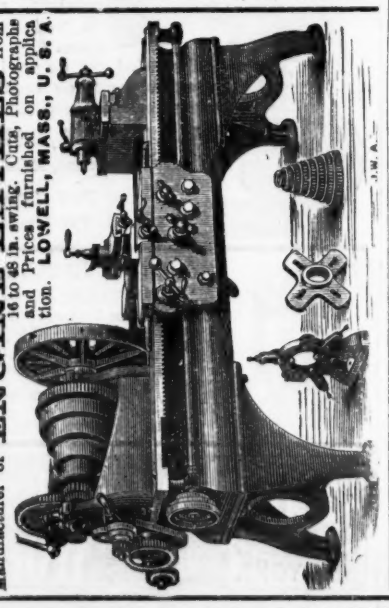

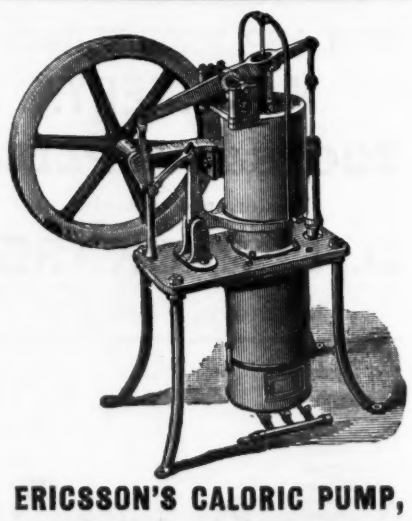

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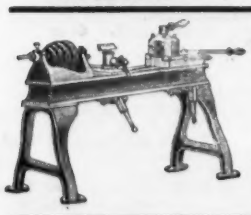

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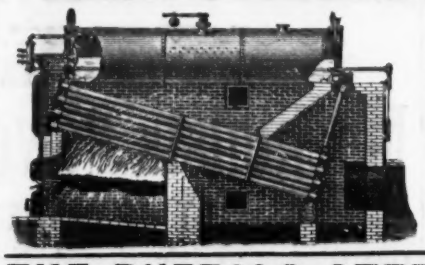

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